Welding Engineer

PRICE 50 CENTS

JULY, 1959

FIREBALL

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ELECTRIC MANUFACTURING CO., INC.
APPLETON • WISCONSIN

The illustrated Miller "Fireball" model DAH-350-L is the **only** welder of its kind:
Powered by 32 hp Hercules engine, the Fireball is an AC **or** DC metallic arc welder; an AC **or** DC TIG welder; a 10 KW 115 230v AC power plant; and delivers 1 KW of DC while welding! Twelve distinct welding ranges, automatic gas control, built-in high frequency stabilizer and power for water coolant system are other advantages. Rated output for tungsten arc is 250 amps AC, 300 amps DC at 100% duty cycle. Three other models available in this series.

Magnetic? OR Electronic? WELDER CONTROL — WHICH WILL DO YOUR JOB BEST?

Square D makes them all... for simplest or most exacting applications!

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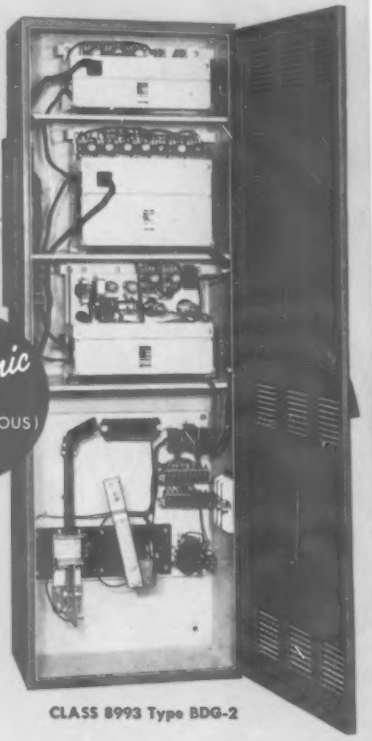
for General Purpose Machines

For applications requiring widely varying welding conditions, normal welding speeds and maximum simplicity.

CLASS 8992 Type BBG-1



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CLASS 8993 Type BDG-2

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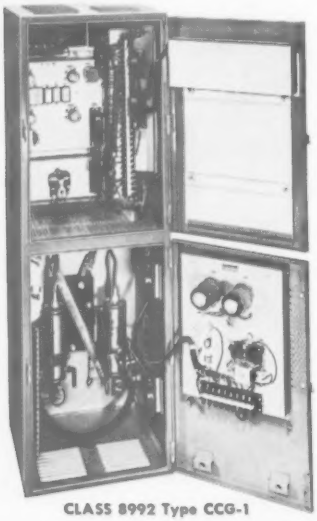

CLASS 8992 Type CCG-1

You'll find your nearby **Square D Field Engineer** *a source of sound counsel in selecting the welder control best suited to your application.*

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SQUARE D COMPANY

TRY... COMPARE

...for proof of **extra advantages** you get with—

HOBART WELDERS

EXTRA Built-in Features make **HOBART** your best welder value!

1. DUAL CONTROL—1000 possible welding combinations at operator's finger tips. Solves the problem of getting just the right heat for each and every welding job.

2. REMOTE CONTROL—saves climbing back and forth for adjustments when working at different levels—conserves floor space when welder can be mounted overhead.

3. POLARITY CONTROL—A simple, compact, positive acting switch lets operator change polarity instantly—no work interruptions, no chance for burnouts.

4. EXCEPTIONAL ARC STABILITY—Hobart's Multi-Range design employs special windings, extra turns and added copper, providing inherent reactance that gives exceptional arc stability in all ranges.

5. END TO CENTER COOLING—sirocco type blower with involute housing brings a controlled flow of cool air in at both ends, forces it through and around generator parts and expels heat laden air at rear.

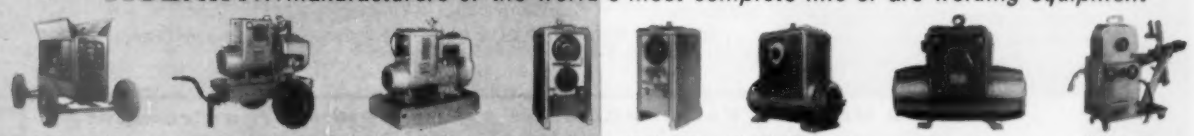
Hobart offers the top welder investment on today's market. First a Hobart welder offers you more features—built-in at the factory—at no extra cost to you.

Second, these features enable you to operate more efficiently, boost your production and cut your costs.

Visit your Hobart dealer or send in the coupon below for complete information. Then compare Hobart with any other welder. This comparison will firmly establish Hobart as the best—best in features, best in performance—the most for your money.

HOBART BROTHERS CO., BOX U-79, TROY, OHIO, U.S.A., PHONE FEderal 2-1223

HOBART... *manufacturers of the world's most complete line of arc welding equipment*



Gas Engine Drive | AC Welder/AC Power | "Husky Boy" | AC/DC Welder | DC Rectifier | Electric Motor Drive | "Powromatic" | "Migare"

A Handful of Savings for you!

HOBART'S *New* ***"ROCKET 24"***

Iron Powder Electrodes

Yes, each handful of "Rocket 24" electrodes you use will represent savings to you. These new contact type electrodes are heavily coated with iron powder that becomes part of the weld, for greater speed, strength and smoothness.

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I'd like to know more about the cost-saving features of the Hobart line.

Tell me more about_____amp. electric drive.

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☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8

☐ Would like to try your No. 24 Electrodes.

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Position_____

Firm_____

Address_____

HOBART'S new "335"

- speeds welding operations
- assures high quality welding
- lowers fabrication costs

HOBART WELDERS • ELECTRODES

YOU BENEFIT

from HOBART'S "Mine to Finished Product" advantages

Only Hobart controls every step in the electrode manufacturing process—from the minerals they obtain from their own Florida mines to their ultra modern electrode manufacturing plant in Troy, Ohio. Rigid controls in every phase from raw materials to finished electrodes guarantee the highest quality in the industry.

● Highly recommended on assemblies of mild steel, plates and shapes where high quality of weld deposit is essential. The new "335" (E-6011) is particularly suitable for structural steel welding, pressure piping systems, pressure vessels, bridges and similar types of construction requiring speed and quality.

HERE'S WHY THE NEW "335" ELECTRODE IS OUTSTANDING

- **Easy arc control in all positions**
- **Exceptionally good physical properties**
- **High speed, high melting rate**
- **A forceful direct arc**
- **Easy slag removal**
- **Uniform, smooth slightly convex welds**

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There's a HOBART ELECTRODE for every welding requirement

Choose from Hobart's complete line of welding electrodes—automatic wire and fluxes

Samples sent on request—just use the coupon

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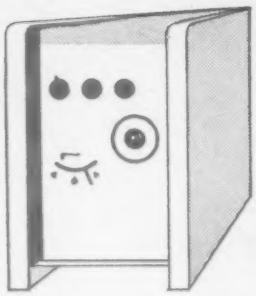
A non-profit school that teaches new welding techniques, and special training for specific production jobs. Comprehensive courses for beginners, or brushup courses for experienced operators. Hobart methods help operators do superior plant production work.

Vol. 44 — No. 7

Welding Engineer

The magazine of joining and severing materials

This is welding: July, 1959



An evaluation of Mig and CO_2 welding 22

In Mig and CO_2 welding, selection of the proper process, or variation, for a particular application necessitates a knowledge of their metallurgical and physical characteristics. **G. H. Cotter** details and compares these two processes and several variations.

How to select arc-welding machines 26

▶▶▶ The manner of metal transfer is the deciding factor in choosing an arc-welder for a specific application. Author **Bela Ronay** shows how correlating this factor with the welder's electrical characteristics will determine selection of the welding machine.

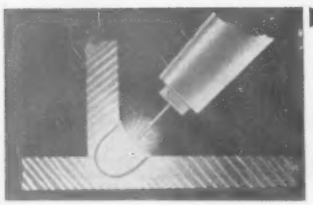
Rhode Island river spanned by all-welded bridge 31

Following the example of numerous other states, the smallest of the 50 recently erected its first all-welded bridge—a 352-ft-long structure across the Blackstone River.

Sealed, plastic transformers keep maintenance costs low 32

Resistance welding transformers fail for various reasons, but dirt, moisture and lubricant accumulations are the most frequent gremlins. **William Emaus** describes development and construction of a transformer unit designed to combat these contaminants.

Modified Mig method fusion-welds thin materials 47



▶▶▶ Using a constant potential power source with a drooping effect, plus an argon-carbon dioxide shielding mixture, this newest Mig welding method can produce welds in all types of joints in all positions when joining carbon steel, stainless, aluminum, copper, etc.

Also in this issue:

USS Enterprise, once valiant vessel, is being scrapped 21

Inco's welding forum hits the road 25

Nuclear properties of plutonium (PU) being studied 29

CO_2 process is miserly with fabricator's $$$$$$ 34

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Twin wire feeds speed tractor part rebuilding 50

Welding helps run Seattle's trolley buses 51

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Welding manganese steel casting of Renner dipper to ManTen plate with Airco Easyarc 308 — the electrode welders prefer. It not only turns out a crack-free weld, but its operation is smooth and uniform, and restriking characteristics are excellent.

how Renner **PUTS THE BITE ON PRODUCTION COSTS** with **EASYARC 308**

Fast-growing Renner Manufacturing Company holds down the cost of fabricating Renner dippers . . . avoids the problem of preheating weldments . . . and, at the same time, produces crack-free welds. Renner uses Airco's new Easyarc 308 AC-DC metal powder electrodes.

Easyarc 308 lowers production costs because it costs less than conventional stainless electrodes. It lays down a fine looking stainless steel deposit with only a small amount of slag that can be removed easily without a chipping gun. And it delivers a high quality weld.

Other uses. On all high carbon steel applications, wherever there could be the slightest chance of cracking, Renner relies on Easyarc 308.

Do you have competition? The lower production costs possible with Easyarc 308 can help you to compete more effectively. Investigate Easyarc 308 . . . the new stainless electrode at low cost. Phone your Authorized Airco Dealer. He's listed in the Yellow Pages under "Welding Equipment and Supplies." Or, contact Airco direct. Ask for Catalog 1318.

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Welding Engineer

America's pioneer publication which, combined with The Acetylene Journal, has been devoted to the interest of the welding and allied industries since 1898

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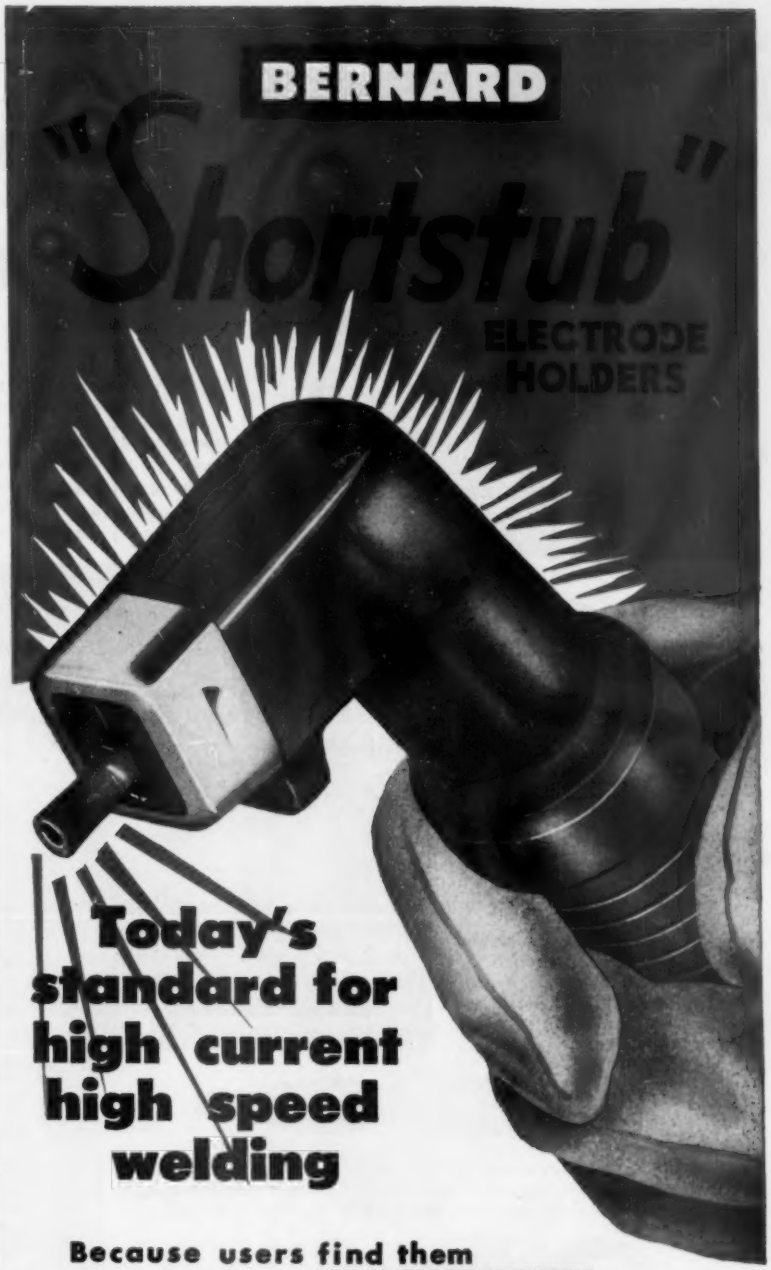

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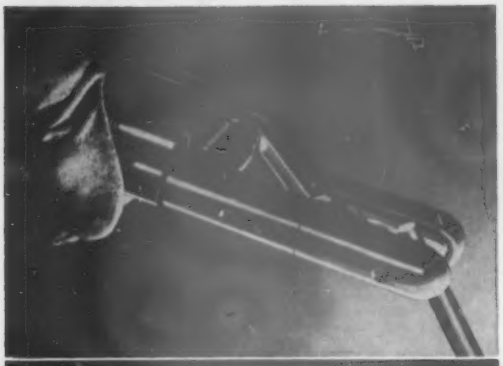


Insulated Copper Alloy Holders have greatest strength, hardness and conductivity. Jackson insulators have highest heat and impact resistance. Choose them where greater duty cycles are called for.

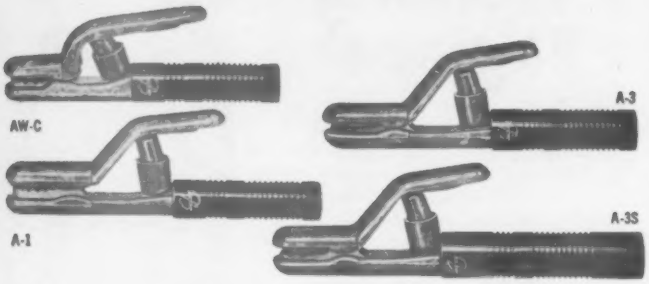
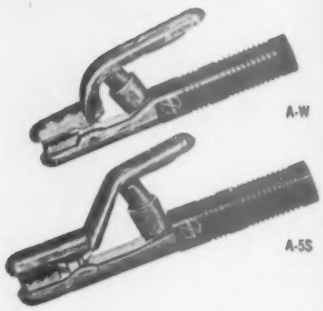


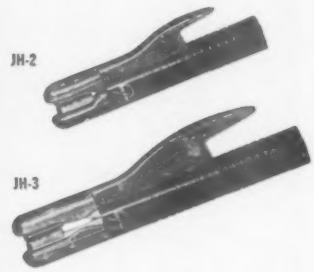
Table shows duty cycles possible with Jackson Insulated Copper Alloy Holders, using electrodes and cables shown.

Holder Class	Model	Electrode	Amps & Cable	Amps & Cable	Duty Cycle
Small	AW-C	7/32"	250—No. 1	300—1/0	50%
Medium	A-1	1/4"	300—1/0	350—2/0	50%
Large	A-3	3/8"	375—2/0	450—3/0	65%
Heavy-Duty	A-3S	3/8"	500—4/0		80%



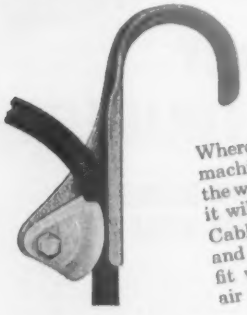
Featherlight medium class model A-W takes electrodes through 1/4" at 300 amps, weighs 14 oz. Featherlight larger model A-5S has wider tong and wider handle, takes electrodes through 5/16" at 400 amps.

Featherlight Holders have tongs of aluminum alloy, replaceable jaws of high-copper alloy. Excellent all-purpose holders, each within its rated capacity. Cable connection must be made mechanically.



Featherlight and streamlined, small class JH-2 takes electrodes through 5/32" at 200 amps, weighs 9½ oz. Medium class JH-3 takes electrodes through 1/4" at 300 amps.

'Quik-Trik' Cable Connectors 2/0-R and 4/0-R have neoprene rubber insulators with tapered ends to stretch over cable snugly. They lock out moisture and dirt, don't catch against obstructions.



The Jackson
CABLEHITCH

Where welding is done above the level of the machine, Cablehitch suspends the cable near the work area. More cable may be pulled through; it will not slip back.

Cablehitch cuts operator fatigue, increases safety and efficiency, reduces cable wear. In one size to fit welding cables No. 1 through 4/0, gas and air hose 5/8" through 1" o.d.

Jackson Ground Clamps give broad metal-to-metal contact. They also fit the hand, go easy on, easy off. Angled socket reduces strain on cable, allows wire fastening for extra support of the cable.

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WARREN • MICHIGAN

"Charlie" Davis, John C. Lincoln die within 24 hours of each other

A. F. (Charlie) Davis, vice president and secretary of The Lincoln Electric Co., Cleveland, is dead at 69.

In ill health for several months, Mr. Davis died May 25 in his Shaker Heights (Ohio) home. A graduate of Ohio State University, he joined Lincoln shortly after graduation in 1914, and his service with the firm is exceeded only by that of James F. Lincoln, chairman of the board, and John C. Lincoln, founder, who also died May 25.

Mr. Davis was made vice president and a director in 1925, and

Davis

Lincoln

secretary in 1938. He was also secretary of The James F. Lincoln Arc Welding Foundation. The welding library at Ohio State is named for him, as are several welding awards he established with the American Welding Society.

Mr. Davis is survived by his widow, a daughter and two grandchildren.

John C. Lincoln was 92, when he died in his Scottsdale, Ariz., home. The elder brother of James F. Lincoln, he founded Lincoln Electric in 1893 and was its president until 1928, at which time he became board chairman.

He moved to Arizona about 25 years ago, where he remained active in various real estate and business enterprises. In addition to James, he is survived by his widow, a sister and five children.

AISC conducts lectures on plastic design

The last of 11 lecture series on practical applications of plastic design in steel will start July 7 at the University of California in Los Angeles.

The other 10 series, which are running one evening per week, for six weeks, are currently being conducted in Houston, Dallas, Fort Worth, Atlanta, Birmingham, Miami, Cincinnati, Detroit, Cleveland and Pittsburgh.

Sponsored by the American Institute of Steel Construction, the lectures will provide architects, structural engineers and others, with background and working knowledge of plastic design. The method enables engineers to utilize steel's strength more fully than before in low-rise structures and provides savings in design time and steel tonnage.

Similar series in fall and winter are being planned for a number of other cities.

Tulsa exposition shows many values of welding

Nearly a half million people crowded into Tulsa to visit the International Petroleum Exposition commemorating the 100th anniversary of Drake's discovery of oil. More than 1,500 companies joined forces to present the greatest array of heavy equipment for use in the oil industry ever to be assembled.

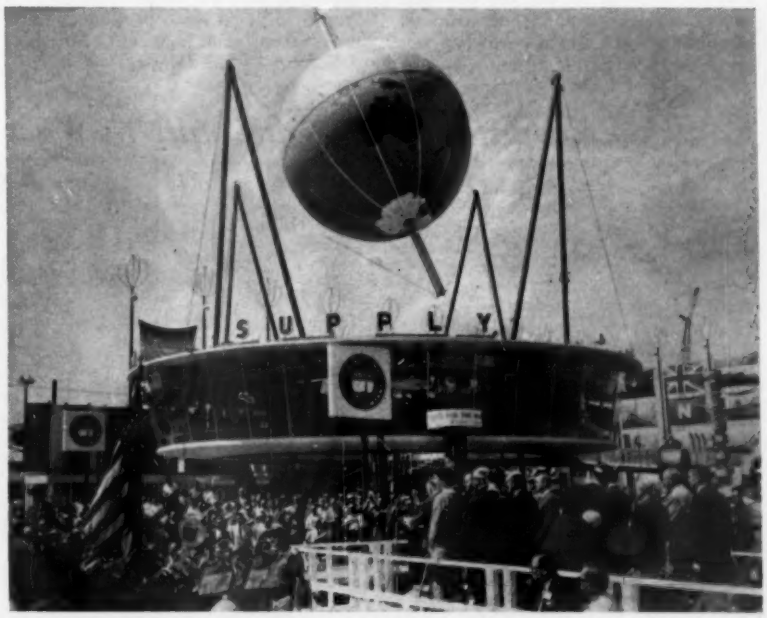
The equipment displayed was for production, exploration, drilling, transportation, refining, natural gas and allied petroleum industry applications. Aside from some 20 drill rigs, several of which were capable of probing nearly 30,000 feet into the earth, there was shown the biggest truck, the biggest pump, etc., along with the biggest of anything else that might be used in the oil industry.

While there were little more than 20 exhibitors associated with the welding industry, the importance of welding to the oil industry was evident on every hand.

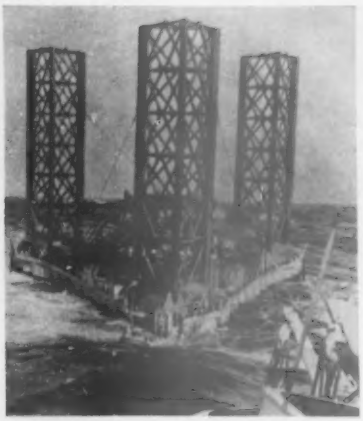
All of the "biggest" items were biggest because they were welded—even the biggest exhibit (see picture). It was the general feeling that welding made the exposition possible, since practically everything displayed was a welded fabrication or supported by a weldment.

The individual company exhibits which ranged in cost from a few thousand dollars, to as much as ten million dollars, included such varied displays as airplanes—and complete drilling rigs. The overall estimated value of exhibits was over $500 million.

Among the outstanding items were turbo drilling equipment, (the space-age approach to oil exploration), and off-the-road trucks 16 ft. 4 in. wide, capable of speeds up to 85 m.p.h., and a gold plated hardfaced drill bit which drilled the last 52 ft in a dry hole, 25,340 ft deep.



ONE of exposition's biggest attractions, a 30-ft globe, rotates above National Supply Co.'s spectacular "Rotarama" exhibit at International Petroleum Exposition in Tulsa, Okla.



MUCH rougher water than this was frequently encountered.

LeTourneau sends its sea island to Italy

A huge, three-legged, self-elevating "portable island" designed and built by R. G. LeTourneau Inc., Longview, Tex., recently completed a rough 7,000 mile tow-voyage from the U. S. to the Mediterranean Sea. Because of the 1,000 ton platform's rugged welded construction, it weathered all heavy seas encountered without damage.

Platform was built at the company's marine facilities near Vicksburg, Miss., and is now being used for drilling offshore oil in Italian waters. It was sold to SAIPEM, subsidiary of the Italian government's own oil company. Originally, the Italians planned to use the machine for exploratory drilling off Iran in the Persian Gulf. Plans were changed, however, and the platform was put to work just off the Gela coast.

The triangular hull measures 120 by 115 ft, with a depth of 13 ft. It is equipped for drilling to more than 10,000 ft, and can raise itself above the water at a rate of one foot per minute.

New Southeast division chartered for Nasco

The new Southeastern Division of Nasco, Inc., chartered as an Alabama corporation, will warehouse, service and sell the entire line of welding and medical apparatus manufactured by National Welding Equipment Company at San Francisco.

National's general manager of its Southern Sales Div., H. L. McElhoe reports that E. O. (Ed) Tucker of Memphis has been named president of the Nasco division, and Joe L. Griffin, Jr., of Birmingham, is secretary-treasurer.

Vice presidents and board members include McElhoe, W. H. Fulton and E. M. Langston. These men represent a combined total of 75 years experience in welding and distribution.

The new corporation office and warehouse is located at 2717 Third Ave. South, Birmingham 5, Ala.

Nasco will both establish and work with a large number of welding distributors throughout the mid-southern, southeastern and southwestern states. It will operate solely as a wholesale organization, and will not solicit business on a direct basis. In order to better service customers, Nasco will also stock products of several other manufacturers, Mr. McElhoe further explained.

COMING EVENTS

SEPT. 24-25: NWSA Central Zone Meeting, Statler Hilton Hotel, Detroit.
SEPT. 28-29: NWSA Eastern Zone Meeting, Hotel Roosevelt, New York City.
SEPT. 28-OCT. 1: National Fall Meeting of the AWS, Sheraton-Cadillac Hotel, Detroit.
OCT. 19-20: NWSA West Central Zone Meeting, Pick-Nicollet Hotel, Minneapolis.
OCT. 22-23: NWSA Western Zone Meeting, Riviera Hotel, Las Vegas.
NOV. 2-6: 41st National Metal Exposition and Congress, International Amphitheatre, Chicago.
NOV. 30-DEC. 1: NWSA Southeastern Zone Meeting, Atlanta Biltmore Hotel, Atlanta.
DEC. 3-4: NWSA Southwestern Zone Meeting, Hotel Texas, Fort Worth.
MAY 5-7, 1960: NWSA 16th Annual National Convention, Palmer House, Chicago.

Japanese welding team visits Progressive Welder

A team of 12 Japanese welding experts recently visited Progressive Welder Sales Co.'s Warren Alloy plant at Pontiac, Mich. Members of the Small Business Welding Specialists Study Team of Japan, the men were specifically interested in Progressive's automated welding equipment for use in the automotive industry.

The team toured the United States for six weeks under the sponsorship of T. W. I. (Training With Industry). Their purpose was to study American industrial techniques which might be of value to Japanese industry. Picture of the group appeared in *WE*, June, p. 57, when they visited the AWS convention and welding show at Chicago.

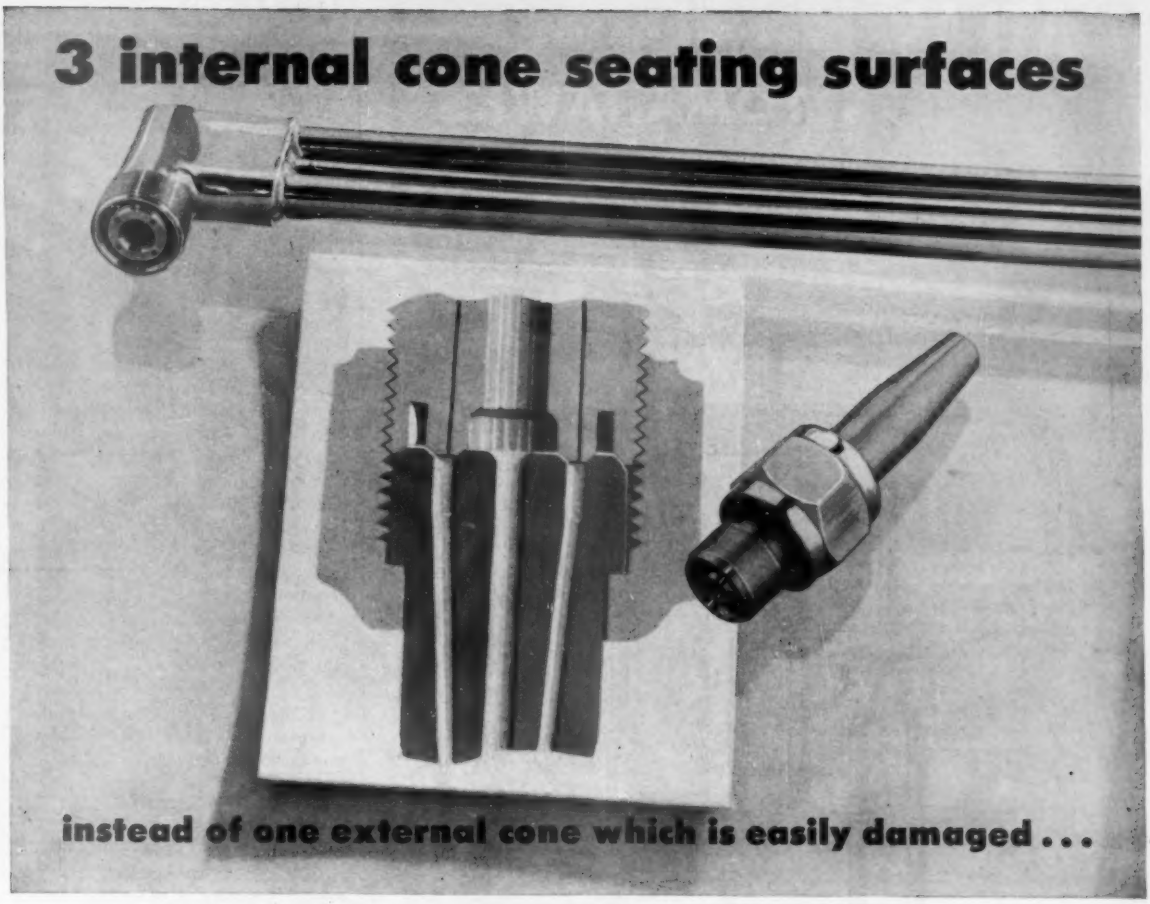
(Additional news on page 52)

First heated outdoor stadium built in West

MODEL of Candlestick Park, future home for San Francisco Giants. Scheduled for Fall of 1959 completion, it will be world's first heated open-air stadium.

HOT water will circulate through welded lengths of wrought iron pipe supplied by A. M. Byers Co., Pittsburgh. Pipe is suspended beneath precast concrete seats.

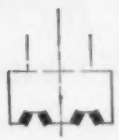
3 internal cone seating surfaces



instead of one external cone which is easily damaged . . .

internal conical seat surfaces do it . . .

external cone — easily damaged



internal cones — well protected

Internally opposing conical seat surfaces are protected against external damage and they permit complete reconditioning by swaging—a process which, on other type tips, might close up all ports. Conical surfaces on the inside—as against outside seating surfaces make all the difference—to tip life—and to your pocketbook.

And—the most modern tip drilling processes assure each and every gas passage absolute uniformity, freedom from distortion and accurate line-up. AFTER ALL, CUTTING TIPS DO COST MONEY—WHY NOT BUY TORCHES AND TIPS WHICH CAN SERVE LONGER.

you won't need to throw away so many cutting tips

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ATLAS | WIDE-BLADE TOMAHAWKS

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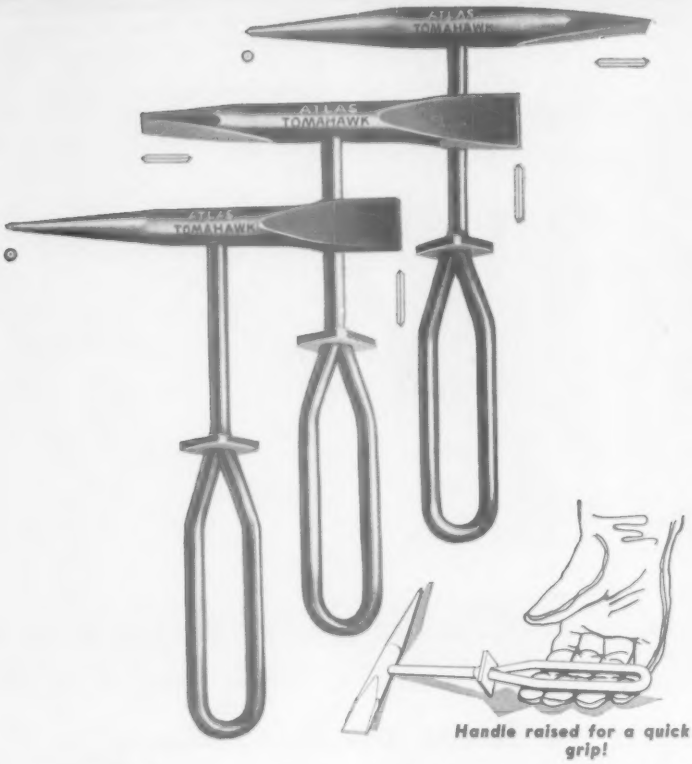

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Letters . . .

Letters should be addressed to: The Editor, WELDING ENGINEER, P. O. Box 28, Morton Grove, Ill. No letter will be published unless signed, but your name will be withheld if requested.

Takes issue

Sir: Coatesville, Pa.

The article entitled "Consider Residual Stresses When Welding", by Professor R. E. Holt, in the June, 1959, issue of Welding Engineer, raises a few questions.

Professor Holt's inferences that residual stresses caused by welding are an important consideration for the designer and welder are not contested. However, it is difficult to understand that the welding sequence for joining structural members in a T-type joint is of primary importance, or even of major importance in more than a few isolated cases.

It is the writer's belief, based on some first-hand observations, that residual stresses caused by the welding operation are more damaging during fabrication or immediately after, than during the subsequent service life of the structure. Shrinkage stresses, for example, can make it very difficult for a welder to finish completely a welded joint, when considerable restraint may be associated with the joint.

Further, the writer would appreciate an explanation of how "a load as little as 30% of the design load can cause a permanent bend of several inches", can be attributed to residual stresses caused by welding a T-joint as illustrated in this article.

An author's task is made extremely difficult when he attempts to concentrate on one phase of a problem in a short article by completely ignoring references to other possibly equally important considerations. For example, in a consideration of residual stresses in a weldment, one cannot afford to ignore the following considerations: (1) type or types (2) compatibility of weld metal and base metal physical characteristics; (3) tolerances on fit-up and alignment at joint; (4) weld joint design and weld size to carry load requirements; (5) internal quality and surface contour of welds; (6) weld sequence.

It would probably be difficult to justify a belief that any one of these points is much more important than the others.

If, in the opinion of the designer, a specific welded joint should be as free of residual stresses as possible, he should not overlook the possibilities of local stress relief after welding is completed.

William H. Funk
Research Administrator
Lukens Steel Company

THIS "CLOCK" is not a timepiece. But it's an impressive example of the precision cutting possible with Messer equipment. All of the figures, offsets, and other features of this dial were cut automatically guided by a photocell with an oxygen cutting machine out of ⅜ inch plate. The dial indicator is actually installed on a heavy forming press in a large steel mill.

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WELDING ENGINEER

Your July, 1959

Weld World

As WE went to press, these were the industry's latest developments:

. . Another manufacturer has raised prices of arc-welding accessories—the second to do so since WE predicted the increase in March.

. . Automatic Mig welding machine for joining aluminum pipe has been introduced by Alcoa. Rotatable head can also be set up to oscillate across weld width to insure proper filling.

. . All products made by Countour Marker Corp., Compton, Calif., will henceforth carry the new trademark "Curv-O-Mark."

. . Rate of annual electrode production has hit highest mark since World War II year of 1944.

. . As WE go to press, steel settlement seems remote. Only a short (less than six weeks) strike will prevent federal intervention, according to most sources.

. . Several aluminum producers have stepped up production—one to 100% of capacity—indicating a good year for the lightweight metal.

. . Merger talks between General Dynamics Corp., parent firm of Liquid Carbonic Div., and Material Service Corp. have been resumed. Latter is Chicago building products producer.

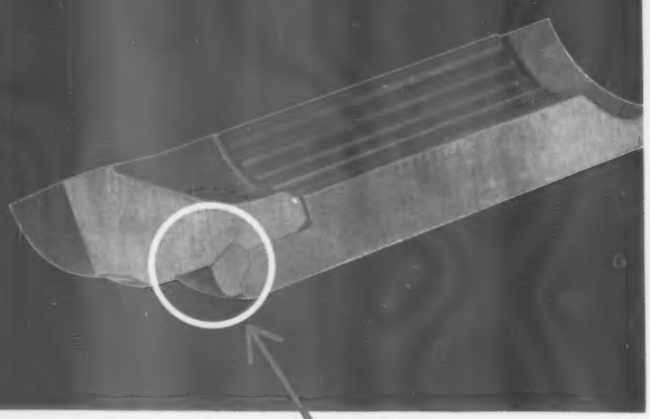
. . Final report from Welding Engineer's Research Dept. shows that welding industry did not suffer as great a drop in revenue in 1958 as was first supposed. Total sales, as published in WE's Fact File issue, were $901,735,141, a decline of 4.5%.

. . Arcos Corp., Philadelphia, has adapted its recently-introduced carbon-dioxide Mig process for field erection of mild-steel storage tanks. Girth seam welding method utilizes Arcosarc—a visible CO_2 automatic process with flux-cored welding wire. Two units, supported by yoke, automatically deposit weld metals on both sides of tank plate.

. . Latest "wrinkle" in welding is corrugated wire for Mig or CO_2 process. Fisher Body Div. of General Motors Corp. developed the idea to compensate for wide trim tolerances in butt and lap joints. The built-in kinks, made by meshing, gear-shaped drive rolls, cause the arc to oscillate, with the resultant weaving action laying an extra-wide bead across the seam.

NEW WIRE

WELDS TWO HIGH-CARBON RESULFURIZED STEELS



Now You Can Weld SAE 1141 to SAE 1151----with CO_2 and

PAGE A-S-18

The cutaway portion of a drive shaft shown above was produced on an automotive production line. It consists of two welded pieces of high-carbon, sulfur-bearing steel—SAE 1141 and SAE 1151. Note the clean metal in the weld.

Previously, it has been impractical to weld these grades of steel by inert gas or submerged arc methods. Pre-heat and post-heat normally were required resulting in the annealing of the pre-hardened sections of the steel.

New PAGE Analysis A-S-18 solves this problem. Using PAGE A-S-18, without pre-heat and post-heat, you can obtain a high-quality, non-porous weld on any free-machining steels in the SAE 1100 series, or on any .25 to .50 carbon steel. For instance, .35 carbon steel joints welded with A-S-18, using CO_2, produced tensile strength of 75/81,000 p.s.i.—yield strength of 55/61,000 p.s.i.—elongation of 24%.

PAGE A-S-18 may be an answer to your welding problem. Why not try it?

A portion of a drive shaft shows perfect weld around circumference, a result of high elongation of PAGE A-S-18. The weld was accomplished in two passes.

Let PAGE Help Solve Your Welding Problems

These Folders can help you

Write for:

Folder DH-402-C Contains information on submerged arc and inert gas automatic welding wire. Lists descriptions and uses of the many PAGE analyses. Describes our extensive variety of packaging. Illustrated.

Folder DH-1218 • Chart lists detailed analyses of PAGE automatic welding wires, metal spray wires, bare electrodes and gas welding rods. Shows uses and physical properties. Lists most competitive makes.

When you bring your welding problems to PAGE, you get the benefit of over half a century of wire drawing experience and leadership in metallurgical research. Leadership evidenced by the industry's widest range of analyses —33 grades designed to do an endless variety of welding jobs. Let PAGE help you improve your quality and lower your costs by furnishing the right wire for your job.

PAGE wire packaging is designed to give you the utmost in convenient storage and handling, whether you require a 1# spool or a 1200# payoff-pallet. Prompt delivery is assured from a coast-to-coast network of PAGE distributors backed up by strategically located PAGE warehouses.

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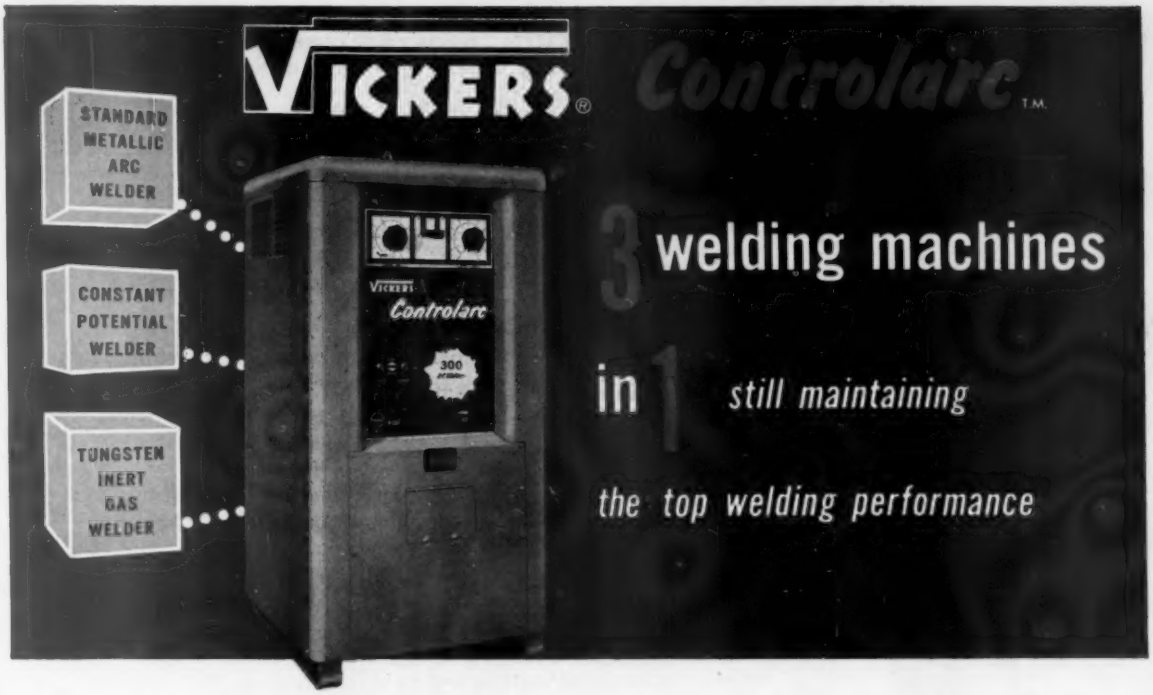

In this versatile welder, Vickers has combined:

1. Standard Arc Welding
2. Constant Potential Welding
3. Tungsten Inert Gas Welding

in ONE Outstanding Machine.

The price is less than half of separate machines!

And this combination has been achieved *with no loss of complete welding performance*. Standard or CP operation is superior to operation of competitive individual machines. Now you can do almost any welding job from this single source, without an expensive investment in multiple machines.

NEW—From Vickers . . . 500 Amp. Constant Potential Welder

Can be paralleled to give any current for any semi-automatic or automatic job requiring direct current constant potential power.

- Built in remote control receptacle.
- Voltage adjustable (stepless) from approx. 13 to 36 volts.
- Slightly falling output slope—may be adjusted internally to flat or slightly rising for special conditions.
- Hot start adjustable. May be internally adjusted to any desirable degree.
- High speed of response.
- No moving parts.
- Quickly paralleled for high output requirements.

■ Contact our nearest welder dealer for prices or call factory!

■ Write for special descriptive bulletins 7136-1 and 7146-1.

EPA 7110-2

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DIVISION OF SPERRY RAND CORPORATION
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1851 LOCUST STREET • SAINT LOUIS 3, MISSOURI

FIRST programmed automation for inert gas welding!

FIRST tape-controlled programming!

Once again P&H sets the pace in welding progress! This time it's equipment for programmed welding.

The new P&H motorized rheostat control brings automation to the welding of Space Age and other super-critical metals. Now you simply dial pre-calculated heat-time values for each job, press the start button, and the control furnishes the exact cycles needed for controlled "upslope", welding cycle, and decay.

And for automated welding at its modern best, P&H offer you exclusive punched-tape control—enabling you to program and control a wide range of heat-time cycles. You can store tapes for re-use —to speed welding and to standardize welding quality at levels far above those possible with human control!

Interested? Contact P&H *now* for additional information. Write Dept. 307A, Harnischfeger Corp., Milwaukee 46, Wisconsin.

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For Spot-Gun or Automatic Welding with built-in controls.

Automatic Spot-Gun Work with controls atop the welder or at the work.

P&H Tape-Programming completely automates the fusion process—gives control over welding impossible by manual methods.

P&H Motorized Rheostat for precise control of heat stages to prevent thermal shock and cracking.

BETWEEN PASSES

mrs. bachelor

The first woman in the United States to earn a bachelor's degree in welding engineering is Mrs. Jane R. Andre, who was graduated from Ohio State University, Columbus, on June 12. She is also the 69th woman granted a bachelor's degree in engineering from the university.

Since its organization in 1947, the school's welding engineering department has awarded 71 bachelor's degrees.

The new engineer was to have been graduated in the top quarter of her class. She eventually hopes to become a research engineer in non-destructive testing.

bon voyage!

Is it our imagination, or is everyone going to Europe these days? More than just a few of our friends in the industry have made trips to Western Europe, while others, under trips sponsored by the government and other organizations, even have been to Russia.

We recently received several picture postcards from Finland, where Martin Friedmann, who is a welding contractor from South Norfolk, Va., and a long-time friend of WELDING ENGINEER'S, was attending an international convention on large dams.

"Now, now, Clyde, you wouldn't really quit. You're just saying that to make me feel good."

Just a few days ago, Jim Alcock, of Saginaw Welding Supply Co., Saginaw, Mich., took off for the continent. Russia is also on his itinerary. This roster of world travelers includes even our secretary, who is touring the Western European countries as this is being written.

If you detect a trace of green in these old brown eyes, you are so right. Ah, well . . . Morton Grove does have its moments.

on the medical front

A recent Associated Press report tells how medical scientists have developed a way of "spot welding" damaged retinas, a key organ of human sight. The scientists have found that breaks or holes in the retina can occur because of faulty blood supply. These holes now can be sealed by focusing an intense beam of light on the desired area. The process is said to amount to spot welding the retina to its underlying structure.

Except for the light source, it sounds more like electron-beam welding.

authors

The 1960 meeting of the American Welding Society is almost 10 months away, but authors who wish to present papers next April should submit abstracts to AWS no later than Aug. 15. That's only a month and a half away.

The 41st annual meeting and the 8th welding show will be held April 25-29 in Los Angeles. Authors' applications, abstracts and manuscripts are screened by the Society's technical papers committee. Each abstract should be sufficiently descriptive to enable the committee to evaluate the proposed paper. Abstracts should contain not less than 500—but preferably not more than 1,000—words.

Copies of application forms may be obtained from: American Welding Society, Dept. P, 33 W. 39th St., New York 18, N. Y.

Meanwhile, the program for the first fall meeting in several years (in Detroit on Sept. 28 thru Oct. 1) has been fairly well established.

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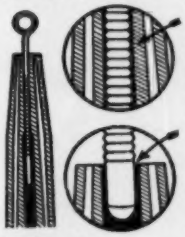
YOU GET SO MUCH MORE IN WYPO Made of Stainless Steel

DOUBLES THE LIFE OF YOUR WELDING AND CUTTING TIPS

The exclusive circle design found only in Wypo Cutting and Welding Tip Cleaners provides as many as 60 more cleaning edges per inch of cleaner.



These rounded outer edges of cleaning ridges clean and polish tip orifice without scratching or cutting.

This smooth pilot guides WYPO Tip Cleaner into tip Will not enlarge or damage tip port.

This cross section view of WYPO Cleaning Surfaces shows these exclusive features:

Rounded cleaning surfaces that won't jam or cut.

Straight sided valleys insure thoro cleaning by removing all waste.

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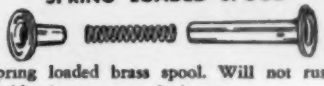
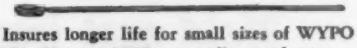


Spring loaded brass spool. Will not rust. Holds cleaners securely in case.

DOUBLE WOUND EYES



Insures longer life for small sizes of WYPO Tip Cleaners. Will not pull out of case.

NOW AVAILABLE IN 3 CONVENIENT SETS

WYPO TIP CLEANERS STANDARD SET

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8	73-72-71
10	70-69-68
12	67-66-65
14	64-63-62
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17	57
18	56
22	55-54
24	53-52
26	51-50-49

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STANDARD SET OF (12) Cleans (27) Drill Sizes Nos. 75 to 49 Incl.

WYPO TIP CLEANERS JUMBO SET

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30	46-45
32	44-43
34	42-41
37	40-39-38
39	37-36
42	35-34-33
44	32-31
48	30

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JUMBO SET OF (9) Cleans (19) Drill Sizes Nos. 48 to 30 Incl.

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CLEANER NO.	FOR DRILL
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12	67-66-65
14	64-63-62
15	61-60
16	59-58
17	57
18	56
22	55-54
24	53-52
26	51-50-49
28	48-47
30	46-45
32	44-43
34	42-41
37	40-39-38
39	37-36
42	35-34-33
44	32-31
48	30

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Replacement cleaners available. Cleaning Range —Cleaner No. & Drill Nos. stamped on back of each case. WYPO GIVES YOU MORE!

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MAITLEN AND BENSON, INC.
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Tack welding cast iron cones to carbon steel vortex tubes of gas scrubber. Ni-Rod "55" Electrodes make ductile, crack-free joints. Scrubbers made by The Aerotec Corp., Greenwich, Conn.

Weld cast iron to carbon steel...no preheat... no cracking...with Ni-Rod "55" Electrode

Joints were cracking up – between cast iron cones and carbon steel tubes in gas scrubbers like this one.

Welds made with carbon steel electrodes were just too brittle. They cracked when slag was chipped away. They sometimes broke entirely from rough handling in shipping.

Then – Aerotec weldors switched to Ni-Rod "55"* Electrodes, specially developed by Inco for welding cast irons. And what a difference – no more cracked welds . . . no more preheating . . . good penetration. And Aerotec finds that with Ni-Rod "55", any weldor of normal skill can do a better job.

Get trouble-free welds between cast iron and ferrous or non-ferrous metals – with Ni-Rod "55" Electrode, available from most distributors.

You'll see a lot of ways other shops have pared costs in Inco's booklet, "Repair Cast Iron Parts Quickly and Easily". Yours for the asking.

*Registered trademark

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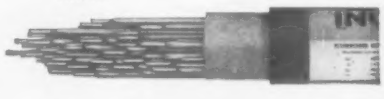
INCO WELDING PRODUCTS

electrodes • wires • fluxes



JULY, 1959

Welding Engineer

ESTABLISHED 1916

183 years of "progress"

ONE HUNDRED EIGHTY-THREE years ago this month, a comparatively small group of colonists declared themselves free of tyrannical bonds and the yokes of oppression.

If they were to see it today, what would these colonists, our forefathers, think of the country for which they sacrificed and struggled?

Certainly they would be amazed—first to learn all but the very poorest live better than the richest of their day; and secondly, they would be astounded by the modern home with its comforts and conveniences.

They would be equally amazed, and probably frightened, by our speed—five hours coast-to-coast via jets, or 100 miles per hour on highways.

Welding, which made most of these changes possible, would also confuse them, as would many of our scientific developments.

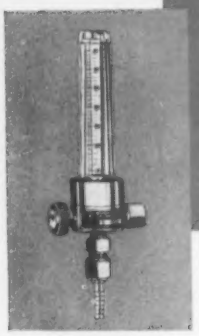
Nor would they understand how a people so adept at improving their living standards could be so inept at maintaining their liberties.

These men fought and died to escape oppressive taxes, yet today some Americans pay 91 cents tax on every earned dollar, a confiscatory tax killing incentive and depriving many others of jobs and opportunities.

Since 1913 per capita income of our country has increased five and one half times, *but the per capita tax load has increased 438 times!*

"Avoid foreign entanglements" was an admonition of these freedom-seekers. But this advice has been ignored for the past 42 years. The result: our country is nearly $300 billion in debt; we have lost friends the world over while giving them $70 billion; and we have reduced the value of the dollar to about 35 cents.

What can we do to regain our freedoms? *(1)* Make our demands for economy in government, lower taxation and a sound dollar known to our Senators and Representatives. *(2)* Elect people to these offices who are interested in preserving our freedoms instead of squandering our income.



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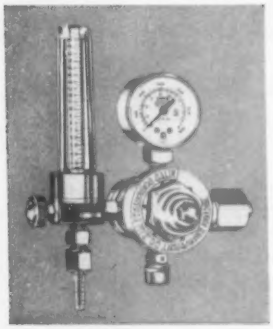
VICTROMETER



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COMBINATION UNIT

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Victor regulators and flowmeters provide accurate, safe control and measurement of gases used in industrial applications, such as welding and cutting; gas shielded arc welding; laboratory work; atmosphere control; furnace operations, etc. For use with oxygen, air, argon, helium, nitrogen, hydrogen, carbon dioxide, and other gases.

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VICTOR EQUIPMENT COMPANY 59

Mfrs. of high pressure and large volume gas regulators; welding & cutting equipment; hardfacing rods; blasting nozzles; cobalt & tungsten castings; straight-line and shape cutting machines.

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Oxyacetylene torches succeeding where enemy failed . . .

USS Enterprise, once valiant vessel, is being scrapped

DURING WORLD WAR II, 911 aircraft and 71 ships tried to destroy the *USS Enterprise*, once known as "the fightin'est ship in the fleet." But instead of sinking the veteran of 20 of the 22 major Pacific naval engagements, the *Enterprise* opponents were themselves destroyed.

The vessel was launched in Newport News, Va., in 1936. She now stands moored to a pier in Hackensack River at the Naval Industrial Reserve shipyard, Kearney, N. J., where she is in the process of being dismantled.

Lipsett Inc. is doing the massive flame-cutting job using Air Reduction Sales Co. oxygen and acetylene.

The huge aircraft carrier was 200 miles from Pearl Harbor on December 7, 1941—but was in the thick of the battle from then on. For her almost single-handed defense against the enemy during the early part of the war, the *USS Enterprise* was awarded the Presidential Unit Citation. This was the first aircraft carrier in history to be so honored.

Last summer, Lipsett bought the *Enterprise* from the Navy to cut it up for scrap. Work began in the winter, with the first cut being made last February.

The superstructure was the first to be sliced apart. Then, moving cautiously to be certain the ship's bouyancy would not be lost, burners attacked first the stern then the stem of the vessel.

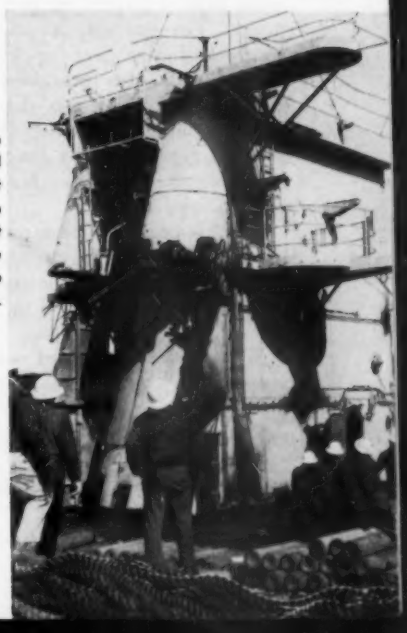
Hull and deck plating, already removed, were cut into 8 by 40 ft sections, hoisted by cranes and dropped into gondola cars waiting on the pier.

Oxygen needed for the cutting job is provided by two trailers on the pier, one stationed at each end of the ship. Portable control units placed behind each trailer are used to break down the trailer pressure of 2,400 psi to the line pressure requirement of 85 psi. Acetylene is supplied by 12-cylinder manifolds.

Both gases are fed through 1-in. hose to headers placed on board the ship. Each deck header has six outlets, each equipped with return valves. Burners on board the ship are hooked to deck headers.

Supervising the scrapping is W. Henry Hoffman, who directed similar jobs on the battleships *New Mexico*, *Idaho* and *Wyoming*. He also headed the job of cutting apart the luxury liner *Normandie*.

If everything goes according to Hoffman's schedule, the entire job will be completed by the end of this month.



WORKMEN started on stern (above) of ship and worked toward stem (at left). Part of island from flight deck is shown at right. Flame cuts can be seen along bottom of piece and at various other places.

GAS-shielded welding processes use basic equipment. At left is the constant potential power source, with wire feeder to the right of it and gas source behind.

by **G. H. Cotter***
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An evaluation of Mig and CO_2 welding

KNOWLEDGE OF METALLURGICAL and physical characteristics of Mig and CO_2 welding processes is necessary for selection of the proper process for a particular application.

Gas-shielded welding has advanced mainly because of its adaptability to automated production. However, this does not mean an early death for submerged-arc welding, since there are applications requiring high deposition rates in which gas-shielded processes cannot compete.

Relative costs will not be compared here. Cost structures depend largely on local wire, flux, gas and labor prices. The engineer should first select that process which will give best or ideal results—then compare its cost with other processes.

Inert-gas welding was developed primarily for joining aluminum and other difficult-to-weld metals. Tig welding, consisting of a tungsten electrode enveloped by a lamellar flow of either helium or argon, was the first process used.

(In this process the tungsten electrode is usually negative; the base plate, positive, *i.e.*, straight polarity.) Tig welding mild steel, however, caused many difficulties and was limited to killed or semi-killed base plate.

When rimmed steel was welded, gross porosity usually resulted from release of trapped gases, and since these steels comprise 80-90% of all mild steel used, Tig welding as such was not too practical.

Replacement of the tungsten electrode with a mild steel consumable electrode of suitable chemical composition was the next logical step. To make this electrode the anode, d-c reverse polarity was necessary.

This metal inert-gas (Mig) welding process could use either helium or argon, with argon preferred.

Where flux cannot be tolerated because of dirt hazard (refrigerator compressors, automotive rear axle housings), or where flux cannot be held in place easily, (small diameter circumferential welds) gas-shielded welding is the only practical solution.

Another advantage of gas-shielding is that no cleaning is needed before painting or plating. (With CO_2 shielding, however, it is necessary to wire brush loose scale and spatter.)

Equipment for gas-shielded welding consists of a power source, a control and wire-feeding device, a semi-automatic handgun and a source of regulated gas.

A constant potential welder, in which arc voltage may be adjusted, is normally used. The wire-feed control supplies wire to the gun at a predetermined speed directly related to welding amperage.

The handgun is a gun-shaped device permitting wire to be directed to the joint while a lamellar gas flow shields it and the arc. (Gun efficiency and construction will have much to do with economy and quality of the process.)

First attempts to Mig weld mild steel were not entirely successful (arc instability, undercutting, spatter, low welding speeds). However, adding 0.05 to 5%

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oxygen to argon corrected these defects.

Primary function of a shielding gas is to protect arc and weld deposit from nitrogen corrosion. Nitrogen is extremely soluble in molten steel, *e.g.*, under a pressure of one atmosphere and at 2,894 F, its solubility is 0.04% by weight.

Dissolved or absorbed nitrogen diffuses too slowly from liquid iron. Thus retained nitrogen is not altered appreciably by the cooling rate and gross porosity often results.

Argon-oxygen-nitrogen mixtures (less than 1% nitrogen) make porosity-free appearing welds. However, they should be given a closer second inspection.

Open hearth steels contain up to 0.005% nitrogen, while Bessemer steels have as much as 0.015%. Generally, steels contain 0.005-0.020% oxygen by weight.

Because of these gases in rimmed steel, a fully deoxidized filler wire is required. Type of shielding gas, the wire's chemical composition and the base plate's composition must all be considered.

Gas requirements are somewhat dependent on current, type of base plate, arc voltage, travel speed and distance from nozzle to work.

Relatively deep penetration, but slow deposition rates characterize d-c reverse polarity Mig welding. Arc voltages range from 24 to 32 volts. Lower voltages give deeper penetration, but increase spatter.

Most welding is done at an arc voltage not less than 26 volts. On the other hand, exceptionally high voltages produce larger arcs, requiring exceptionally good gas coverage.

For each amperage value, an arc voltage must be selected which will give proper arc length without exceptionally deep penetration. Needed penetration is obtained by increasing arc heat and/or amperage, or by merely decreasing arc voltage.

Because of this relatively deep penetration, wire must contain sufficient deoxidizing agents (silicon, manganese, aluminum) to counteract porosity-causing gases released from below the rim.

Typical wire analysis is: carbon, 0.06-0.13%; manganese, 0.80-1.10%; and silicon, 0.20-0.35%. In a shielding atmosphere of 5% oxygen and 95% argon, transfer efficiency of these elements is 80-85% for manganese and silicon, and 60-65% for carbon.

Approximate physical strength of a weld can be calculated from the following: Tensile strength equals ultimate strength—39,000+105,000+14,000 Mn + 16,000 Si, assuming that 0.12% carbon, 0.90% manganese and 0.32% silicon is transferred through the arc.

Thus, tensile strength is calculated at approximately 70,000 psi. (This would be fairly accurate if residual effects could be neglected. This is not the case, however, and tensile strength runs about 5% higher.)

Physical characteristics of a weld deposit made with manganese-silicon killed rod with residual chromium are as follows: tensile strength, 72,000 to 78,000 psi; yield strength, 55,000 to 63,000 psi; elongation, 16 to 18% in 2 in.; and reduction in area, 30 to 39%. These values indicate good tensile and yield strengths—but insufficient ductility.

Argon-oxygen mixtures are preferred to helium-oxygen mixtures because argon is approximately 1⅓ as heavy as air, and 10 times heavier than helium. The effectiveness of gas as a shielding agent depends on its density.

Argon can form a blanket over the weld area because of its density. Helium, being lighter, will rise in turbulent fashion around the nozzle and its flow would necessarily be two to three times that required for argon. With d-c reverse polarity Mig welding, a flow of 45-50 cfh argon is required for most applications.

Because of greater penetration, reverse polarity may be used for butt welds, as well as fillet and lap welds. Nearly 100% penetration can be obtained when welding 3/16-in. material. However, material less than ⅛-in. thick is difficult to weld because of burn-through. Thus, one limitation is difficulty in welding thin-gage materials.

Straight polarity Mig welding of mild steel is possible by coating automatic welding wire with certain metallic oxides.

Normally it is impossible to make a satisfactory weld using pure argon, straight polarity on an unstabilized electrode. The process takes advantage of the higher-burn-off rate. But without an arc-stabilizing material to control burn-off and penetration, burn-off would be 1.8 times that of reverse polarity.

A bare steel electrode also exhibits arc unstableness, but when the coating is added, the cathode or arc flame at the electrode end is stabilized, and permits smooth spatter-free spray transfer. Coating composition is fixed to give a 20% higher burn-off than reverse polarity.

Penetration in most cases is approximately 60% that of reverse polarity.

Wire composition is similar to that used in reverse polarity, but it should be noted that wash coating on the wire periphery has little to do with the deposited metal's composition. Instead, composition depends on core wire analysis, shielding efficiency and type of shielding gas.

Pure argon is usually used with the coated wire stabilizing the arc. However, oxygen-argon mixtures from 1 to 5% may be used.

In pure argon atmospheres, manganese and silicon transfer at 80-85%; carbon at 75-80%. Where a 5% oxygen, 95% argon mixture is used, carbon transfer decreases to 60 to 65%.

Typical core wire compositon might be: carbon, 0.09 to 0.15%; manganese, 0.80 to 1.10%; silicon, 0.30 to 45%; sulfur and phosphorus, not more than 0.3% each.

Physical properties are superior to those of either automatic or manual coated-electrode types. The following data are typical: ultimate strength, 79,000 psi; yield strength, 68,000 psi; elongation 28% in 2 in.; reduction in area, 67%. As can be seen X-ray quality welds can be made with little difficulty.

Deposited weld metal contains from 0.003 to 0.011% nitrogen and 0.005 to 0.03% 0_2 as compared to coated manual electrodes with deposits containing 0.012 to 0.042% nitrogen and 0.04 to 0.11% oxygen.

Higher welding speeds (15 to 22%) can be achieved, saving time and material. Weld appearance is excellent and requires no cleaning. And because of high arc stability and smooth transfer, gas consumption is reduced as much as 33%.

(Table 1 compares gas consumption and weld quality

of straight and reverse polarity Mig welding when used to join refrigerator compressor housings.)

Straight polarity's reduced penetration is favorable for welding thin gage material; reverse polarity would cause excessive heating and burn-through.

The high deposition speeds make this process well adapted to fillet and lap welds and sufficient penetration can be obtained for these two joint designs. Although the process lacks the deep penetration needed for certain butt welds, this lack is not a problem if edges are first prepared.

A relatively new gas-shielding process uses carbon dioxide, and because of its low cost, compared to argon and helium, has received much attention.

Although CO_2 presents some problems, with proper application, wire and equipment, comparable high quality welds can be obtained. However, welding with such a reactive gas presents different metallurgical problems than those of the inert-gas processes.

In the arc, CO_2 disassociates into carbon monoxide and oxygen, a more oxidizing mixture than oxygen itself, causing a thin scale which must be wire brushed.

Physical size of the arc is such that the wire seems to be burning off at the base plate surface. The arc is very short and does not lend itself to manual welding. However, higher welding speeds and deeper penetration than either of the two inert-gas processes is possible.

An electrode having sufficient deoxidizer must be used, since carbon, manganese and silicon losses depend on the amount of deoxidizer originally present.

Reaction is determined by temperature, arc voltage, base material, and concentration or speed of carbon dioxide. As temperature increases, CO_2 solubility and reaction increase. Hydrogen, carbon monoxide or nitrogen gases in molten metal form porosity.

In CO_2 welding of mild steel, a wire of the following analysis is good: carbon, 0.09 to 0.15%; manganese, 0.09 to 1.20%; silicon, 0.35 to 0.50%; phosphorus and sulfur, 0.035% maximum for each.

The silicon, carbon and manganese amounts transferred vary somewhat with arc voltage, amperage, base plate and wire chemistry. However, in most cases these elements transfer approximately as follows: carbon, 50-55%; silicon, 53-61%; manganese, 55-70%.

	Straight Polarity Process	Reverse Polarity Process
Current	360	360
Arc Voltage	24	28
Shielding Gas	Argon with 2% oxygen	Argon with 5% oxygen
Gas Flow Rate	20 CFM	40 CFM
Welding Speed	53 IPM	53 IPM
Percent Rejects	Less than 1%	5 to 8%

TABLE I—Comparison between straight and reverse polarity Mig welding used to join refrigerator compressor housings.

As mentioned above, the weld loses much of its physical strength through loss of carbon, manganese and silicon. Residuals (chromium) sometimes maintain much of the physical strength. As a rule, however, strengths are from 10 to 15% lower.

Weld deposited from a core wire having the composition 0.11% carbon, 1.15% manganese, and 0.427% silicon gave the following characteristics: ultimate strength, 68,000 psi; yield strength, 53,000 psi; elongation, 31% in 2 in.; reduction in area, 58%.

Deposition rate is very high, *e.g.*, burn-off of 1/16-in.-diameter electrode at 350 amp is 13.8 lb per hour. Obtainable speeds are as high as 240 ipm.

The one disadvantage is high spatter loss, which at times amounts to 18-20% of electrode weight. There is, however, a certain current and voltage range in which spatter may be reduced to a minimum.

Fast current response of the constant potential welder could be altered by a special choke coil which retards the rate of current increase.

Use of this coil permits lower current densities, virtually eliminating spatter. Other benefits from lower densities include reduced penetration, relatively wider beads, and an ability to use the process automatically or semiautomatically for vertical and overhead welding.

The resulting reduced penetration makes it possible to weld thinner gage materials which cannot be welded with the conventional carbon dioxide welding process.

Note that these advantages can be gained only by using lower current densities (which are 40-50% of those used in the conventional process).

Shielding gas consumption in this process depends on the gas nozzle used, joint type, and the current and voltage. Gas flow rate varies from 15 cfh at 320 amp to 35 cfh at 520 amp, 26 volts.

The process is limited to applications where deep penetration can be tolerated. It is not generally suited for fillet welds because of the narrow bead.

However, the process is excellent for burn-through and lap welds where excessive fill is not required, and for butt welds in 3/16 and 1/4 in. materials where no joint preparation is practical.

The carbon dioxide process is not essentially a semiautomatic process, but rather an automatic one where fixturing and machine type application will produce high-quality welds efficiently and at high welding speeds.

JOINT between end cap and compressor housing must withstand 200 psi air pressure. Joint was Mig welded, d-c straight polarity.

Inco's welding forum hits the road

SINCE late 1950, The International Nickel Co., Inc., has conducted about 60 welding forums for fabricators at its Bayonne, N. J., facility. About 1,100 welding engineers, supervisors, etc., have participated in these week-long sessions. But in May Inco's welding forum went on the road. Condensed forum was conducted in Milwaukee's Auditorium on May 13 and 14. Total of 187 men representing 53 companies from Wisconsin and environs attended. Shown at right is part of first day's attendance. Inco's Ken Spicer, extreme left, and H. B. Bott, standing by welding booth, conducted forum which included sessions on brazing, hardfacing, Mig and Tig welding of high nickel alloys. At lower right is Spicer using brazed specimen to demonstrate stresses.

PRIOR to session, Howard Breitzmann (left), master mechanic, Chain Belt Co., Milwaukee, examines coated nickel electrode, while W. Stark, process engineer, Modine Mfg. Co., Racine, Wis., examines sample welds.

MORE questions were thrown at Bott (left) after a session. Quizzing him are Joe Potochnik, nuclear power engineer (center), and Louis J. Larson, consulting engineer, both of Allis-Chalmers Mfg. Co., Milwaukee.

MIDWEST distributor for Inco is Steel Sales Corp., which acted as host. Milwaukee was chosen for forum because industry in Wisconsin area is well diversified. Forum lasted five hours each day, but Inco personnel were on hand from 9 a. m. to noon if any registrants wanted personal attention or demonstration. Shown during break (from left) are Al Olen, manager of Steel Sales' Minneapolis office; Al Zino of Inco's New York sales office; Ed Witort of Steel Sales' Milwaukee office and Creighton Strick of Steel Sales' Rockford, Ill., office. Jim Ryan of Inco told WELDING ENGINEER that requests from distributors and customers over the past five years prompted firm to try "road show." Success of Milwaukee venture may result in more such condensed forums.

FLICKER and flutter, respectively, indicate improper and proper machine-to-electrode relationships. A fluttering arc light indicates a far smoother metal transfer and finer globules.

by **Bela Ronay**

How to select arc-welding machines

Correlate the welder's electrical characteristics and the electrode's transfer properties

THERE ARE TWO WAYS of buying arc welding equipment: by price alone, or by correlating electrical characteristics of welding machines and the metal transfer properties of the electrodes for which the machines will supply current.

Obviously, the latter criterion is the proper one to apply, but it forces the purchaser to familiarize himself with both factors—the machine and the electrode.

Arc welding machines are bought for a specific job, or for general use where material to be welded and weldment geometry are known. The electrode class and size range is also anticipated.

Basically, there are only two major electrode groups, and the characteristic which distinguishes them is the manner in which metal is transferred from them through the arc. In the first group, metal transfer is intermittent and occurs in the form of tiny globules. Metal transfer from electrodes in the second group takes the form of a fine spray. (See figure 1.)

Experienced weldors know that weld metal travels through the arc in globule form, but many of them regard this fact (and the fact that globule size varies with electrode type) as having little more than academic interest. Such a viewpoint is unfortunate, for the manner of metal transfer from various electrodes is *the deciding factor* in choosing welders for specific applications.

Just why this is so may be better understood if the reader will mentally place himself in the role of an observer as a weldor prepares to deposit E6010 electrodes. You, the observer, test the equipment this weldor is using and ascertain that both current and voltage are normal for the type and size of electrode on hand. You further determine that his deposition technique will be a conventional one, and that he is skilled.

Now, you turn your back to him as he strikes an arc, and on a wall or other unbroken surface, you watch the arc reflection. It *flickers* (is extinguished and relit in rapid succession), and the frequency of the flickering appears fairly constant.

Having some knowledge of motion picture projection techniques, you know that the eye detects frame separation when film speed is less than 16 frames per second. You therefore know, on the basis of the flickering reflection, that metal transfer through the arc maintained in depositing an E6010 electrode, is occurring at some frequency *less* than 16 frames per second.

Turning to another weldor who is set to deposit an E6020 electrode, you once again satisfy yourself that current and voltage values are correct, and that the weldor is skilled

". . . the manner of metal transfer is the deciding factor in choosing welding machines for specific applications."

and is using an accepted technique. Watching the reflection of this arc, you detect a *flutter—i. e.*, a continuous light of rapidly varying intensity.

Having made these observations, you may pose these questions: *(1)* What does flickering or fluttering indicate? and *(2)* What do they mean electrically?

The answers, in simplified form, are as follows:

(1) Every time an arc flickers, it is being extinguished—short-circuited by a droplet of weld metal. During this short circut, there is no voltage (hence no light), although a heavy current passes through the shorted-out circuit of the arc. When the droplet flattens out in the deposit, voltage recovers, the arc becomes luminous, and current value returns to a normal rate.

A fluttering arc light, on the other hand, indicates a far smoother metal transfer and finer globules.

(2) Electrically, flicker and flutter respectively indicate improper and proper machine/electrode relationships. This is apparent when it is understood that welding machines designed for use with electrodes having intermittent metal transfer characteristics possess built-in functions which restrict the range of current fluctuations and smoothout the arc.

There are tests—requiring the use of complex scientific instruments—to determine the ability of welding machines in giving smoother arc performance. But there are very few machine purchasers who are equipped to make these tests.

Generally, industry procures welding machines on the basis of *(1)* a general consideration concerning suitability of the machine for the electrode type used most frequently, and *(2)* a reliance on the integrity of the machine manufacturer that his product is properly constructed and will perform as represented.

Manufacturers now offer welding machines in four basic types: *(a)* constant-potential; *(b)* variable-potential; *(c)* transformer, and *(d)* rectifier.

Constant-potential machines usually are large-capacity (1,000 amp and up), multiple-operator machines. Their electrical characteristics (volt-amp relationship) may be represented by the straight line shown in figure 2. This diagram presents current fluctuations under normal welding conditions for a c-p set operating at 60-volt open-circuit potential, and another which operates at 72-volt open-circuit potenial.

The figure shows also that current fluctuaton for the 60-volt open-circuit machine is about 1½ times greater than for the other set. The arc for the latter, therefore, is smoother and results in a more finely rippled, smoother and sounder deposit.

There is a third volt-amp curve in figure 2 which represents a 90-volt open-circuit condition. For the latter, current variation is smaller than for the 72-volt curve. This median level in both open-circuit potential and current fluctuation is typical for large c-p sets, and satisfies requirements for such work as shipbuilding.

The 90-volt open-circuit voltage curve shows how much smoother the arc is under that condition than with lower open-circuit voltages. The c-p machine, therefore, is suitable for the average condition, where the best in workmanship is not mandatory.

One of the chief advantages of c-p sets is that their performance remains fairly constant even though primary circuit potential is subject to a fluctuation of ±10%. Inertia of the heavy rotor of these machines performs the role of a flywheel, which maintains revolutions at a constant speed to assure constant open-circuit voltage as well.

Variable-potential welders—the so-called motor-generator sets—were until recently the most widely-used source of welding current. For applications that require portability, the generators are furnished as gasoline engine-driven units.

An outstanding feature of the variable-potential set is "dual control," which permits open-circuit voltage to be set independent of current rate. This means that a weldor can select for each electrode type and size the open-circuit voltage that provides

Group I—Intermittent types: Cellulosic, titania, lime types.	Group II—Spray or continuous type: High iron oxide and iron powder types.
E-6010	E-6020
E-6011	E-6030
E-6012	E-6014
E-6013	E-6018
E-6015	E-6024
E-6016	E-6027
(All other 15 and 16 types, and all non-ferrous electrodes.)	

FIG. 1—The two general classes of electrodes listed on the basis of their metal transfer properties.

Safety in welding

IN FEW CIRCUMSTANCES is the adage, "Familiarity breeds contempt," more justified than in arc welding. The open-circuit voltage of all types of welding machines can be high enough under certain conditions to send a lethal charge of current through the human body.

The resistance of the human body when dry is high enough to resist the admission of a lethal current dose. But body resistance is lowered greatly by perspiration and minor skin injuries; this combination, in fact, may reduce body resistance from its normal value of 300 to 500 ohms to less than 100 ohms.

A body with a resistance of 100 ohms admits 0.8 amp when the open-circuit potential is 80 volts. Passing through the heart, ½ amp a-c or ¾ amp d-c are lethal charges.

(It should be further noted that a-c is more dangerous than d-c because the victim cannot release the contact.)

What should you do to prevent any possibility of electrocution while welding? Follow these simple safeguards:

1—Wear gloves that are in sound condition, and immediately replace those that become worn.

2—Wear shoes that have thick rubber or composition soles.

3—Avoid standing in water or on a steel deck while arc welding. Use a wooden grill or a rubber mat to provide dry footing and electrical insulation.

4—Do not change electrodes with your bare hands.

5—Use *only* fully-insulated electrode holders.

6—Do not leave electrode stub in holder.

Safety demands continuous caution on the part of both supervisors and weldors. Stay *alert* and you'll stay *alive!*

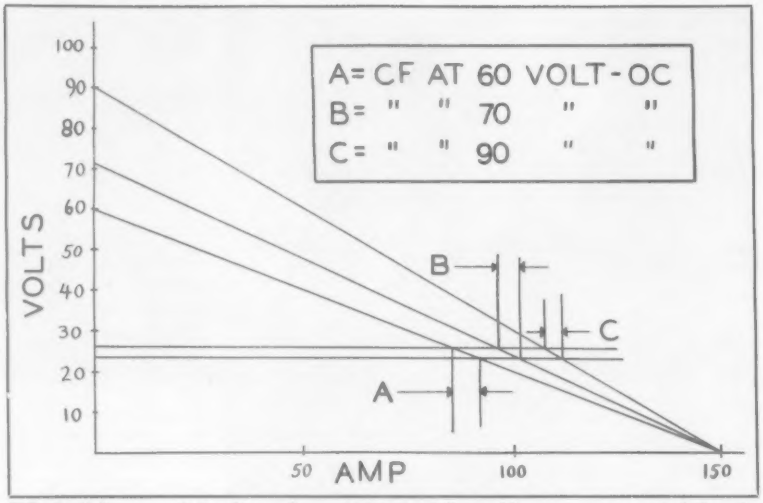


FIG. 2—Volt-amp relationships of constant-potential machines are represented by the straight line. Diagram shows current fluctuations under normal welding conditions for c-p sets operating at 60, 72 and 90 volt open-circuit potential.

the least current fluctuation for most economical electrode application. He can also, as stated above, reset open-circuit voltage or current rate independently of each other.

Unfortunately, with most m-g sets presently on the market, the weldor cannot make full use of his machine's potential because of the lack of indicating equipment. One brand of machine, however, has a painted disc under the open-circuit selector knob on certain models. This disc is divided into segments, each painted a different color and marked for various welding positions.

The problem of obtaining the best setting for each electrode type in all the various welding positions is rendered relatively easy by the use of such a device. *But*, there are no simple devices to guide the weldor in finding optimum open-circuit voltage and making a proper current setting —so he must waste time in finding the right combination and, if he fails, produce defective welds.

In the hands of weldors who have worked out their own method for obtaining optimum machine settings, the m-g is a precision tool when compared to the constant-potential welder. The stepless regulation of both open-circuit voltage and current rate that can be obtained with the intelligent use of m-g sets is conducive to the production of uniform, high-quality welds.

Another valuable feature of m-g sets is ease with which polarity can be changed—only a small switch need be thrown. Change of polarity on a c-p set, however, necessitates the disconnection, interchange and reconnection of both ground and welding cables.

The rotor of an m-g set, like that in a c-p machine, is a flywheel also. Consequently, m-g sets will overcome fluctuations in primary-circuit voltage if it doesn't exceed ±10%.

Transformer welders are constant-potential sets, but unlike their d-c counterparts, they usually are provided with a device for stepless current regulation.

Since transformers lack the high-inertia elements of the rotary c-p and variable-potential machines, they do not have the ability to counteract fluctations of the primary voltage. For this reason, transformer welders are unsatisfactory in plants where power line capacity is inadequate to maintain voltage within ±5% of the nominal, regardless of load variations.

Where a large number of single-phase transformers are used, care should be taken in connecting them to a three-phase line to avoid unbalancing the power circuit.

Within the past decade, all-position a-c electrodes—counterparts of the E6010 type—were produced for use in transformer welding. Some shipyards now use a-c welding exclusively. The transformers also are suitable for fabricating shops where work can be positioned to permit the use of downhand electrodes—types which yield more weld metal per time unit than the E6010 variety.

Transformer welders also are wide-

ly used as power sources for automatic welding, particularly with the submerged-arc process.

Tubeless rectifier welders are the latest development in welding machines. Design features of these units make them the most desirable power source for manual, semiautomatic or fully automatic welding.

Because d-c power is less dangerous than a-c (within the range of the open-circuit voltage of welding machines), these machines are produced with a fixed open-circuit potential of 82 volts or more.

Recalling our earlier comments on the beneficial effects of open-circuit potential on weld metal soundness, it should be noted that open-circuit voltage of the recifier welder is a built-in assurance of smooth metal transfer through the arc in all positions and for all electrode sizes within the range of any given machine.

Currently, fabricators of high-pressure, high-temperature equipment, and of piping and heat exchangers containing nonferrous metals or austenitic steels, use rectifier welders almost exclusively in manual metal-arc welding, or in manual or semiautomatic inert-gas welding.

Rectifier welders contain three transformer coils, one for each phase of the three-phase primary circuit. Thus, any number of these machines can be connected within the limits of power line capacity without unbalancing it.

Several manufacturers are producing rectifier welders as combination a-c/d-c units. By flicking a switch, the weldor may obtain the current which best suits the job at hand.

Rectifiers and combination ac-/d-c machines do have one shortcoming which they share with all transformer type welders. They do not have a built-in high-inertia component corresponding to the rotor of c-p or v-p sets. Consequently, they exaggerate primary voltage fluctuation.

The performance of all transformer welders, including rectifiers, becomes critical when primary circuit potential is subject to voltage variations exceeding ±5%. The plant which desires to exploit advantages of rectifier welders, therefore, must provide primary power lines of adequate capacity for both existing and anticipated electrical loads.

Nuclear properties of plutonium (Pu) being studied

PLUTONIUM—a product of fissionable Uranium-235 and U-238—has a promising future, and may become our major source of nuclear fission energy.

Plutonium has many properties to recommend it for this important role, but it has many disadvantages, too. It is a deadly poison and will explode with little provocation, creating a murderous radiation shower.

Because of the difficulties involved in working with plutonium, Argonne National Laboratory in Lemont, Ill., operated by the University of Chicago for the Atomic Energy Commission, has built a $4,000,000 Fuel Fabrication Facility designed to advance man's knowledge of plutonium.

Welding plays an important part in the operations of the laboratory, but it was also instrumental in its construction. (See picture.)

WELDOR works on inlet filter boxes located at outer end of hood line.

Built so scientists could safely conduct experiments, the laboratory houses an integrated system of 106 hoods or glove boxes branching out from each other in a herringbone pattern. The operating hoods range in volume from 18 to 800 cu ft, and are joined to one another by an airtight, 102-ft-long conveyor.

A helium atmosphere will be used in the hoods. Helium was chosen because it minimizes the hazards of fire and oxidation and allows the processing of combustible materials.

Hoods are gasketed to prevent air leakage and have synthetic rubber gloves clamped into ports in glass viewing panels. To work in the chambers, technicians merely place their arms into these gloves.

Four types of work will be carried out in the new facility: fabrication of reactor fuels containing plutonium alloys; assembly, welding and bonding of previously fabricated plutonium cores in non-radioactive jacket materials; metal working of jacketed pieces; inspection of completed fuel elements, for which no protection is required.

Welding and other hoods were constructed so contamination could be kept at a low level, allowing finished pieces of radioactive fuel to be welded into uncontaminated jackets.

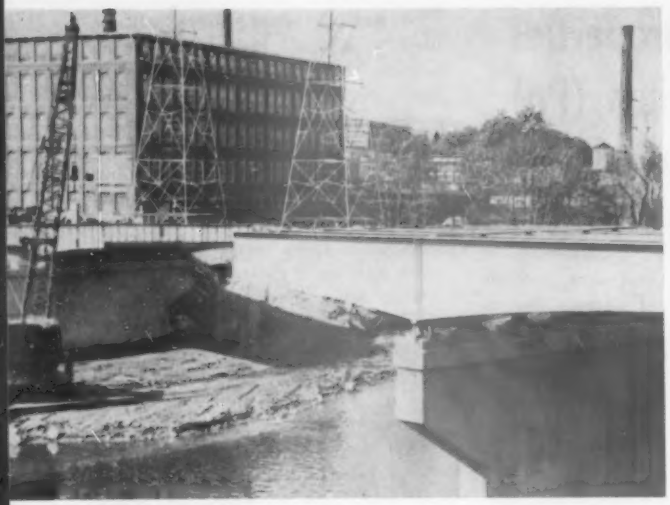
In spite of all the precautions, however, the specimens to be jacketed will sometimes become contaminated. For this instance, a special hood has been equipped to decontaminate these specimens.

Equipment for welding and jacketing includes a clamping press consisting of a structural steel frame holding four pneumatic cylinders operating a water-cooled platen. The frame is carried on swivels which allow 210-deg rotation of the press.

This entire assembly is mounted on a carriage which can be powered along tracks beneath a welding torch. The torch can be moved up, down or across the direction of the press movement, providing three-deg motion between the clamping press and the welding head as well as providing rotation of the work.

Workpieces are clamped in a horizontal position, and the press rotated 90 deg for welding. When the first longitudinal seam weld on a fuel element assembly is completed, the press is rotated 180 deg so the second weld can be made without unclamping the assembly.

A rotary positioner that can hold ⅞-in.-diameter round work is also used. The positioner is a modified milling machine indexing head equipped with a worm drive and power input shaft driven by a variable speed gear motor.



ABOVE, at left, view of erected east section of bridge, and across river, first girders being placed for west shore section. At right, workman watches as crane places internal girder for west section.

Rhode Island's Blackstone River spanned by state's first all-welded bridge

FOLLOWING THE EXAMPLE of many other states, Rhode Island recently erected its first all-welded bridge—a 352-ft long structure spanning the Blackstone River in Woonsocket.

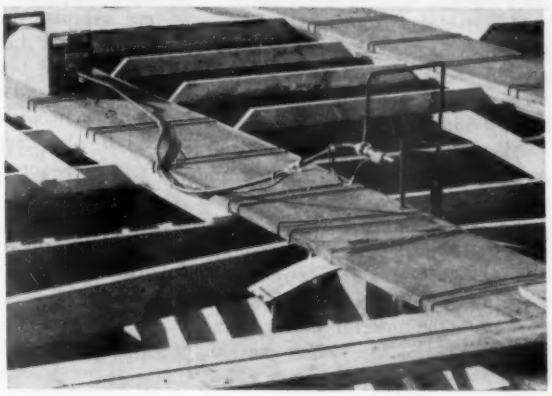
First, design and fabrication specifications for the continuous cantilever type bridge were formulated by the engineering department of the State of Rhode Island—then the job started to roll.

Tower Iron Works of Providence was contracted to fabricate the girders needed. But, prior to welding of the girders, a mobile X-ray unit from Pittsburgh Testing Laboratories set up preliminary inspection facilities at the Tower Works plant, and tested weldors.

According to the plans of the state engineering department, the bridge was to consist of three sections—one on each shore and one in the middle —each composed of twelve 120-ft

ALL girders for the 352-ft span have been placed, and workmen are installing wood grid decking. Section not yet covered shows how cross-frames are placed from girder to girder and joined at stiffeners. Old bridge is at left.

EQUIPMENT set up for gamma ray exposure of weld. Portable iridium camera with remote control is shown.



GAMMA-ray equipment is in place for inspection of girder bottom flange.

girders. Two fascia girders and 10 internal ones were used for each section.

The girder flanges range in size from ¾ by 18 in. at the ends to 2 by 18 in. at the piers. Webs were made from 7/16-in. thick steel plate, with stiffeners on each side ranging from ⅜ by 6 in. to ¾ by 8 in.

Stiffeners were spaced at 3 ft. 6 in. to 5 ft 9½ in. centers, depending on location, and joined to webs with 5/16-in. fillets.

The webs were welded to the flanges with a 5/16-in. fillet on both sides. Submerged-arc welding was used in fabricating the girders.

Flange splices were butt welded using a 60 deg included angle with a double-Vee joint and 1/16-in. land spaced ⅛ in. In some cases, the butting flanges were of different thicknesses, so the thicker flange was chamfered to a slope not greater than 1:3 before welding.

In constructing the cross-frames, angles measuring 3½ by 3½ by ⅜ in. were welded on both sides with 5/16-in. fillets at the crossing and the same where the angle and stiffener meet.

During girder fabrication top flange splices were radiographed 100%, bottom flanges and the 17-in. web sections, 50%. Approximately 460 ft of radiography was needed.

All fabrication and radiography of girders was completed within six weeks. Sections were then stretched out in the fabricator's yard and visually inspected.

The steel was temperature checked and each section measured so allowances could be made for possible expansion and contraction when the bridge was finally erected.

Next, the 16-ton girders were shipped to the bridge site for assembly of the superstructure. Here, 72 field welds were made, and each one 100% radiographed.

Field erection and general contracting was handled by W. J. Halloran Construction Co.

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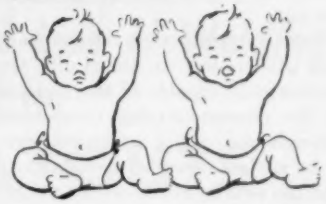

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When resistance welding . . .

Sealed, plastic transformers keep maintenance costs low

by **William Emaus**
Chief Electrical Engineer
Kirkhof Manufacturing Corp.

RESISTANCE WELDING TRANSFORMERS can fail for many reasons, but the most frequent single cause is the gradual accumulation of dirt, moisture and lubricants inside the mechanism which ultimately cause shorting out.

In most transformers the contaminants will produce an electrically conductive path capable of shorting one of the current-carrying components through the unit's grounded case, or by surface creep between contacts. The tap switch, which carries the full primary voltage, is particularly susceptible to shorting.

Disabled transformers are expensive to repair, they require a manufacturer to have replacements on hand, and they can cause a costly slowdown in production.

To eliminate these problems, Kirkhof Mfg. Corp., Grand Rapids, Mich., completely redesigned its 50, 60, 70 and 100-kva fixture-type Power Pa"K" Transformers to make them, for all practical purposes, short-proof. To do this, two unique approaches in transformer design were followed.

First, a sealed construction to keep contaminants out was developed. Second, a high-impact plastic was substituted for most of the metal structural components. The structural parts are molded from Thermaflow, a high strength glass reinforced polyester compound manufactured by Atlas Powder Co., Wilmington, Del.

The material is strong, a good insulator and resistant to heat, a wide variety of chemicals, oil and grease. It can be molded to close tolerance with precise detail, a property which simplified development of the transformer's sealed construction.

All metal fastenings, and current-carrying members in primary and secondary sections of the transformer, are anchored, mounted or molded into the plastic. It being an excellent dielectric, this automatically isolates the metals from ground and each other.

A major design achievement is the completely sealed tap switch and well-enclosed secondary section which keeps moisture and other contamination from the interior of the transformer. Previously, switch mechanism was constructed in such a way that it was difficult to get a good, permanent seal, and dirt and moisture was able to seep in.

The new design has the switch mounted on a plastic base which is closed off by a mating cover and permanently sealed around the rim by gaskets and sealing compound.

All mechanical connections between the internal current-carrying parts and the exterior (switch shaft, switch handle and power-plug cover) are also molded from polyester. Use of this dielectric material eliminates creep between contacts inside the switch and current leakage from the switch outside.

For all practical purposes, it is impossible for any part of the transformer to short out through the case to ground.

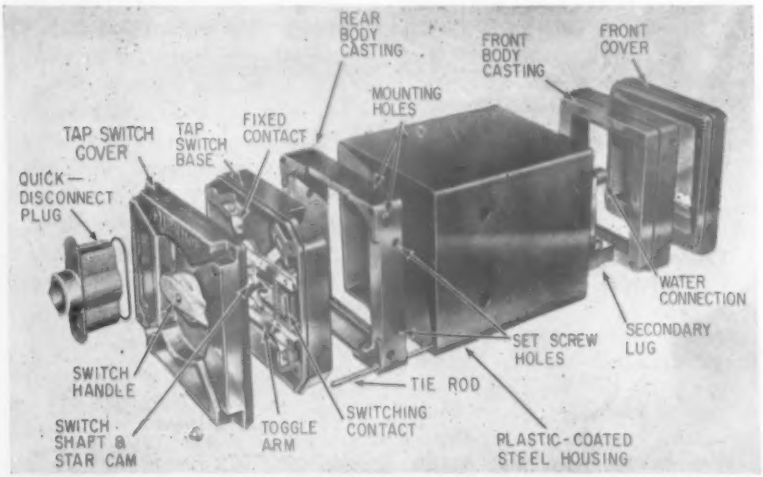
This totally insulated design also provides a definite safety advantage. Because all external parts, except the low voltage carrying secondary pads, are covered with the dielectric material, workmen are protected against the possibility of getting an electrical shock from an internally-shorted transformer.

Major structural elements of new transformers are: fully-enclosed tap switch, a pair of rectangular frames which support static and dynamic loads of the transformer, a housing for the secondary, and a cover plate for the secondary end of the transformer (See picture).

Except for the secondary housing, which is a drawn steel shell insulated with a cellulosic coating, all these parts are compression molded from the plastic compound.

An excellent maintenance-free record has been established by the transformers during two years on the welding lines of a major automotive manufacturer. Records show a substantially lower failure rate for the plastic units as compared with the old metal transformers.

The new ones had an annual repair rate of less than 1%. Of the 2,166 units in service, only 17 (13 of which were damaged by physical



EXPLODED view of transformer. All units meet JIC and RWMA standards and are color-coded in red, blue, green and yellow to distinguish between the various capacities. Transformer dimensions: height, 9 in.; width, 7 in.; length, 15 to 21 in.; weight, 132 to 210 lb; depending on capacity.

abuse or improper operation) required repair during a one-year period. But, for the 11,809 earlier models still in use, an annual repair rate of 6 and 13%, depending on the model, was recorded.

To break this down—for every 10 conventional models fixed, only one new model required attention.

Use in other plants (including another large automotive facility and various metal fabricators) has shown similar impressive maintenance records. Of 850 Power Pa"K"s placed in these plants, only 5 have failed. One of these failures was due to defective materials, the others (all from the same plant) were the result of improper application.

These are the figures, you can draw your own conclusion. But it would be difficult to reach one other than that the new design is paying off to the resistance weldor's advantage.

In addition to eliminating chronic maintenance problems, redesign was also aimed at improving performance. The new transformers have a 90% higher thermal capacity and a 136% greater current output with no increase in overall size over the original units.

Devising an efficient cooling loop for the secondary coils, and developing a core casting for the secondary base to permit water cooling of the entire base, made these increases possible.

These components also cool the connecting secondary shunts, thus increasing shunt life and thereby cutting replacement costs.

Another maintenance-savings feature, optionally incorporated in these transformers, is a quick primary disconnect plug. It provides fast, convenient and safe connection of the primary to the transformer. After installing the plug, the primary can be disconnected or reconnected to another transformer almost as simply as plugging in a television set.

All units have identical mounting and cross-sectional dimensions, excepting length. This allows interchangeability of transformer capacity and eliminates costly reworking of mounting brackets, shunt arrangements, etc., when a transformer size must be changed to meet the requirements of a machine.

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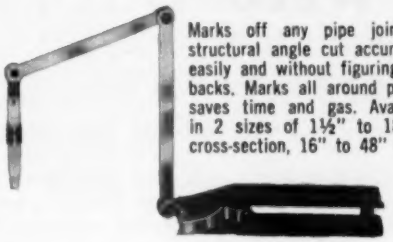

Marks off any pipe joint or structural angle cut accurately, easily and without figuring cutbacks. Marks all around pipe—saves time and gas. Available in 2 sizes of 1½" to 18" in cross-section, 16" to 48" diam.

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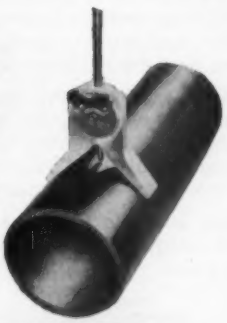

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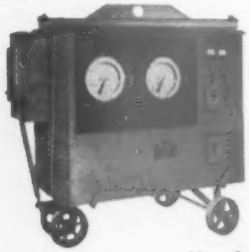

Electronic recording gives permanent charts of heat run on this standard Smith-Dolan model. Coils permit work at 50 feet or more from unit. Eye hooks provide for easy handling by crane. Products ranging from a fraction of an inch to 10 feet in diameter can be heat treated on the job.

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CO_2 process is miserly with fabricator's $$$$$$

by **J. F. O'Connell**
J. C. Kelley*

HIGHER SPEEDS and lower costs aren't the only criteria for switching to a new welding process, but they're good reasons for giving the process a try.

After hearing Linde Co.'s claims about its semiautomatic CO_2 shielded magnetic flux welding process, the J. B. Beaird Co., Inc., Shreveport, La., decided to experiment with substituting the process for the manual metal-arc welding operations it was currently using in fabricating large storage tanks.

Why did Beaird try it? Because the process was claimed to be three to four times faster and 40% to 60% cheaper than the manual process the firm was currently using. But, also, the process was said to cut spatter loss, require almost no post-cleaning, and increase weld quality.

The CO_2 process is now used to make 5/16-in. fillet welds in the fabrication of 4-ft by 10-ft mild-steel tanks. The welds are made using a 3/32-in. mild-steel wire, magnetic flux and a CO_2 shield. A current of 450 amp, 31 volts d-c on reverse polarity powers the unit.

The new process has been adapted to two phases of tank construction, sealing girth joints and joining stiffeners.

Girth joints are sealed prior to submerged-arc welding to prevent flux and molten metal from falling into the container. The new method, with which one man seals the joints in nine minutes, replaced a manual process with which it took two men 23 minutes each to do the same job. The circumferential welds are now made at a rate of 34 ipm.

The new machine is also used to join the three stiffener rings needed for tank support. In this operation,

*Mr. O'Connell is chief welding engineer for J. B. Beaird Co., Inc. Mr. Kelley is a welding sales engineer for Linde Co. in New Orleans.

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Speed up the hard-facing operations in your plant with HAYNES Hard-Facing Machines . . . and enjoy substantial savings. Mechanized hard-facing is fast. It produces sound, uniform deposits on a production basis. And it requires less alloy per part hard-faced.

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Our field engineers can help you determine which of your hard-facing jobs are suitable for mechanization. For full information on HAYNES Hard-Facing Machines and on the wide range of HAYNES Hard-Facing Alloys, write our general sales office in Kokomo, Indiana.

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Send today for this important manual, "Mechanized Hard-Facing." Find out more about this production method.

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The heart of the Transport is a group of Taylor-Wharton seamless steel pressure vessels. Their quality, established by closely controlled manufacturing processes and rigorous inspection, makes the Taylor-Wharton Transport a sound investment in durable, up-to-date equipment. All vessels are normalized for extra safety and manufactured to I. C. C. 3A2400 specifications. Available in capacities of 38,500 to 56,000 cubic feet, the vessel groups are rigidly mounted on modern single or tandem-axle trailers. A weatherproof rear housing protects the valve and manifold system.

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GIRTH joints at tank ends are sealed with new process.

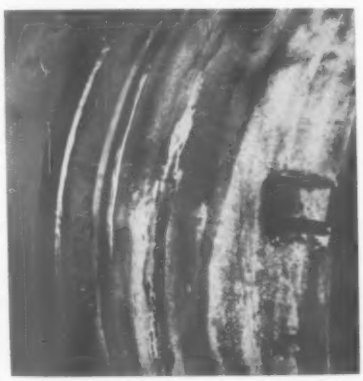
an operator positions the head over the stiffener while the tank is revolved and the fillet weld laid.

A total of 1,650 ft of welds are made per eight-hour shift, compared to less than 350 ft made with the old method.

Speed was not the only advantage Beaird gained when it decided to permanently adopt the new process. The new equipment produces welds of higher quality than the manual metal-arc method, while requiring neither elaborate jigging nor highly-trained personnel.

Also, post-welding operations were almost completely eliminated. The protective welding composition used usually peels off by itself, and the resulting weld surface is smooth enough for painting, requiring no grinding or buffing. No spatter is left which must be removed.

Due to the savings in time, labor and materials, actual welding costs with the new process on this application are 75% lower than with manual metal-arc welding.



SHINING circumferential and fillet welds require no post-cleaning.

Failure of any part of a missile—be it the mighty Atlas, Jupiter or Thor—can mean failure of the mission. That's why the complex connections in the ducting systems of these and other missiles are silver brazed. These connections must stand up under 6,000 psi; they are tested to 12,000 psi.

In lines made to specifications by Flexonics Corporation, Maywood, Illinois, silver brazing joins a corrugated flexible pressure carrier, a braid sleeve and a coupling nipple—all of stainless steel; it permits joining all of these elements of the assembly without danger of annealing the pressure-carrying flex or the restraining braid as welding might do.

Assemblies designed for 6,000 psi operating pressure are required to withstand a 12,000 psi test and take four times their normal operating pressure before failure. They may also be required to pass a flame test in order to meet specifications.

The silver-brazed connections are used on hydraulic and pneumatic systems, fuel drain lines and vent tubes. Some of these applications involve rigorous service with extreme pressure shocks accompanied by sudden elevations of temperature, which may go from −60° to 400-600° F in a matter of seconds.

A more "high level" endorsement of Handy & Harman silver alloy brazing is not available. On the ground or in the air, the qualities of this remarkable metal joining method apply; strength, ease of production, cost, gas and liquid joint tightness to name a few. The entire brazing story is yours merely for the asking. Inquiries and metals-joining "problem exposure" may be addressed to Handy & Harman, 82 Fulton Street, New York 38, N. Y. We welcome the opportunity to work with you.

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Assemblies in ATLAS Missile

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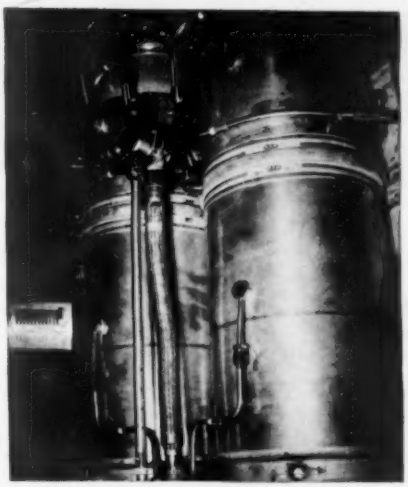
Intercontinental Atlas missile being made ready for launching.



Close-ups of missile section, showing silver alloy brazed ducting assembly.

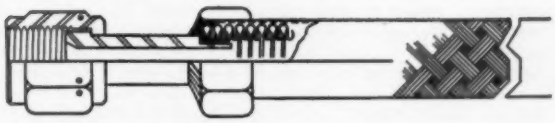
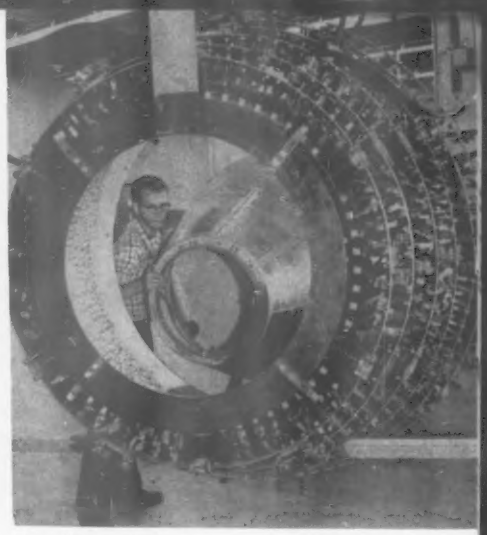


Diagram of pressure carrier.

FOR A GOOD START: BULLETIN 20.

This informative booklet gives a good picture of silver brazing and its benefits...includes details on alloys, heating methods, joint design and production techniques. Write for your copy.

CRADLE brackets are being welded to bottom half of reusable container, one of series developed by Baltimore Steel Co. for shipping engines and components for commercial and military aircraft. Prior to development of such containers, engines were subjected to oxidation and shock during shipment that often damaged vital parts. Hermetically sealed units protect contents from oxidation with 5 lb of pressure. Internal supporting brackets mounted on shock absorbers in bottom of unit cushions contents. Containers come in 6 to 16 ft lengths, 20 to 60 in. in diameter. Units are sealed by inserting rubber gaskets in flange welded to rim of container's bottom half. Jalten, a high-strength, low-alloy steel manufactured by Jones & Laughlin Steel Corp., Pittsburgh, is used in container fabrication.

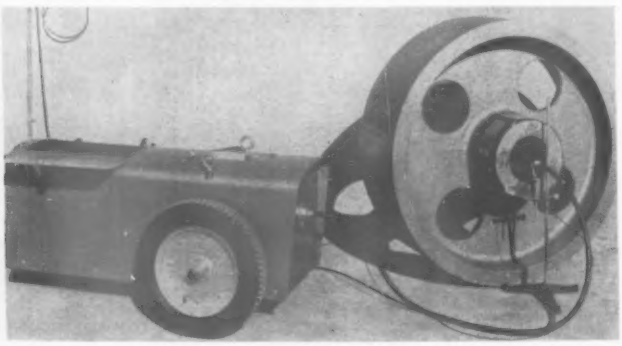


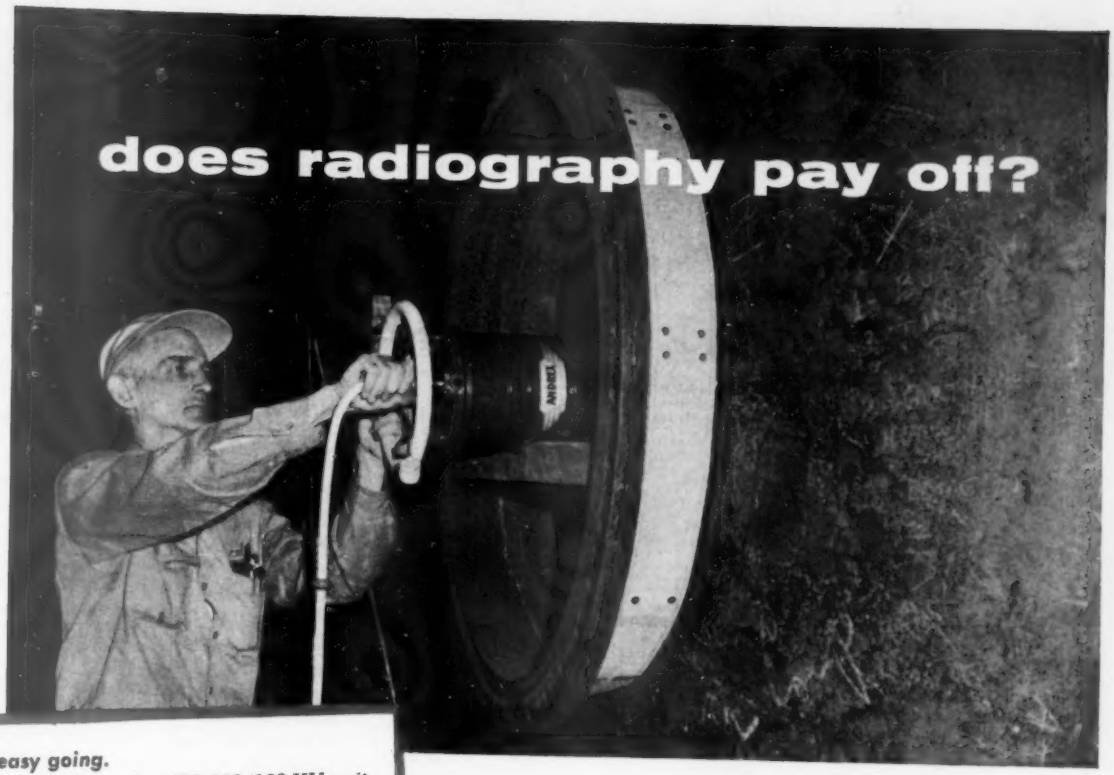
IN order to duplicate severe temperature conditions encountered when a ballistic missile re-enters Earth's atmosphere, this circular test oven was devised by engineers at U. S. Army Ordnance Michigan Missile plant near Detroit. It is operated by Missile Div. of Chrysler Corp. (See *Army's Jupiter and Redstone missiles . . .* p. 42, April). Hundreds of individual quartz heating lamps were combined to make this unit. Welded nose of Redstone missile is being readied for testing.

On the job...

INSTALLATION of open flooring at multi-level coal preparation plant in northern West Virginia enables personnel to supervise operations on several floors at same time. Electroforged steel-grating floor is made by Blaw-Knox Co., Pittsburgh. Here, sections are lined up and welded to provide surface stability. Easily maintained flooring is designed with roughened twisted bar surfaces for safe footing. Approximately 75,000 sq ft of grating was used.

REMOTE, mechanized handling of a radioactive cobalt 60 pill for radiographic inspection of castings and weldments is provided by control unit below, hooked to lead storage safe, below at right. Operator and control are stationed behind 18-in. thick walls of 7-ft. high concrete enclosure. Gate is closed before pill is propelled from safe through tubing to point of use inside hub of 38-in. diameter sprocket blank. Film is wrapped around hub. Geiger counter is kept near operator to indicate radiation level. Unit is used by National Supply Co., Torrance, Calif.





easy going.
The 64 lb. Andrex FT 360/160 KV unit here emits full-circle radiation: it will radiograph the entire girth weld of a vessel in one "shot". Films are held in place by a snap-on canvas band circling the neck.

x-ray is best for some jobs.
In that case the right machine for you probably lies somewhere in the comprehensive range of x-ray units listed below.

gamma ray (from radioisotopes) is better for others.
With one machine or another in the broad Picker line of isotope units you can radiograph anything from thin aluminum up to 10" thick steel.

unbiased advice free for the asking.
With an equipment line like that (nothing like it in the field) we have no axe to grind for any particular kind of machine: we can *afford* to be unbiased.

Does radiography pay off? Ask steel tank and pressure vessel fabricators—from now on in they couldn't *live* competitively without it.

Look: the new ASME code, Section VIII, ascribes 100% efficiency to a welded joint radiography-proved sound: the weld is considered strong as the mother metal even without stress-relieving. Which means that steel thickness of a radiographed vessel can be less than the thickness of a non-radiographed one.

Ergo: radiography can save tons of steel.
Ergo: radiography saves far more than it costs.

An extreme example? Hardly: hundreds of case records are as dramatic. Call in your local Picker man to find out what radiography (or fluoroscopy, maybe) can do for you. You'll find Picker offices in all principal cities (see local phone book) or write or wire us at the address below.

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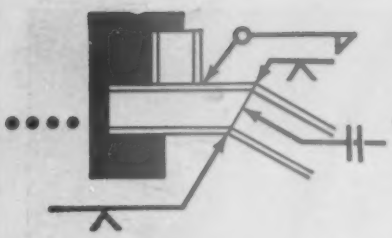
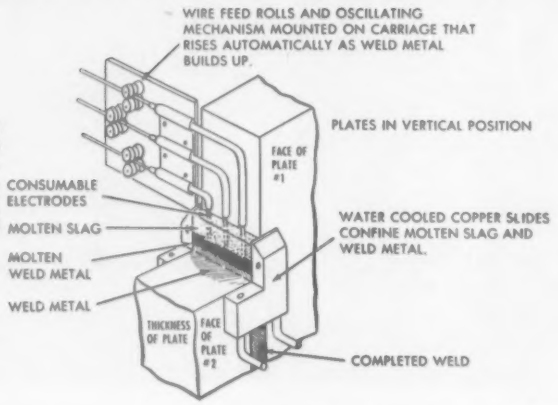
PICKER	x-ray units—35 KV Beryllium window, 90 KV, 150 KV (stationary and mobile), 270 KV portable, intensified image fluoroscopes
TECH/OPS	units for isotope radiography—sources, equipment, containers for Iridium ^{192} Cobalt ^{60} Thulium ^{170} and Cesium ^{137}
ACCESSORIES	. . films, tanks, darkroom sundries, illuminators, *everything*



the welding clinic

Here you may find the solution to your welding problems, whether they concern design, production, construction or maintenance welding. Submit your questions for answering on this page.

Electroslag welding procedure detailed


WIRE FEED ROLLS AND OSCILLATING MECHANISM MOUNTED ON CARRIAGE THAT RISES AUTOMATICALLY AS WELD METAL BUILDS UP.
PLATES IN VERTICAL POSITION
FACE OF PLATE #1
CONSUMABLE ELECTRODES
MOLTEN SLAG
WATER COOLED COPPER SLIDES CONFINE MOLTEN SLAG AND WELD METAL.
MOLTEN WELD METAL
WELD METAL
THICKNESS OF PLATE
FACE OF PLATE #2
COMPLETED WELD

HEART of electroslag unit. All components are symmetrical so apparatus can be easily set up for welding with head to left or right of guides.

Question:

We have heard a great deal about the electroslag welding process, but have never seen a detailed description of how this process actually works. Could you provide us with such details?

Answer:

Electroslag welding involves the fusion of parent metal and continuously fed weld metal under a substantial layer of high temperature, electrically conducting molten slag, says Arcos Corp., Philadelphia.

Electroslag is mainly used to vertically weld plates of medium and great thickness. Flame-cutting of edges is the only preparation needed.

To weld, plates are set in a vertical plane and the edges to be welded are positioned and spaced. The gap is bridged by water-cooled copper shoes on each side forming, in effect, a mold for the molten metal and giving the required contour to the finished weld. The shoes are mechanized so they move vertically upwards as welding proceeds (See drawing).

Contact between the shoes and the plates is maintained by pressure exerted from flexible arms. The automatic movement of the welding nozzle and shoes, and the automatic feed of wire and flux are controlled by a set of relays operated by contacts attached to one of the shoes. This control keeps a consistent head of slag above the weld pool.

When starting, a block is placed below the plate edges to close the welding cavity. Granulated flux is dropped into the cavity. Then, an initiating arc is struck with the wire in a way similar to starting submerged-arc welding.

Arc energy is used to fuse the flux into molten slag which then, because of its temperature, becomes a highly ionized mass offering a path of relatively low resistance to current flowing from the wire to the weld pool and adjacent plate edges.

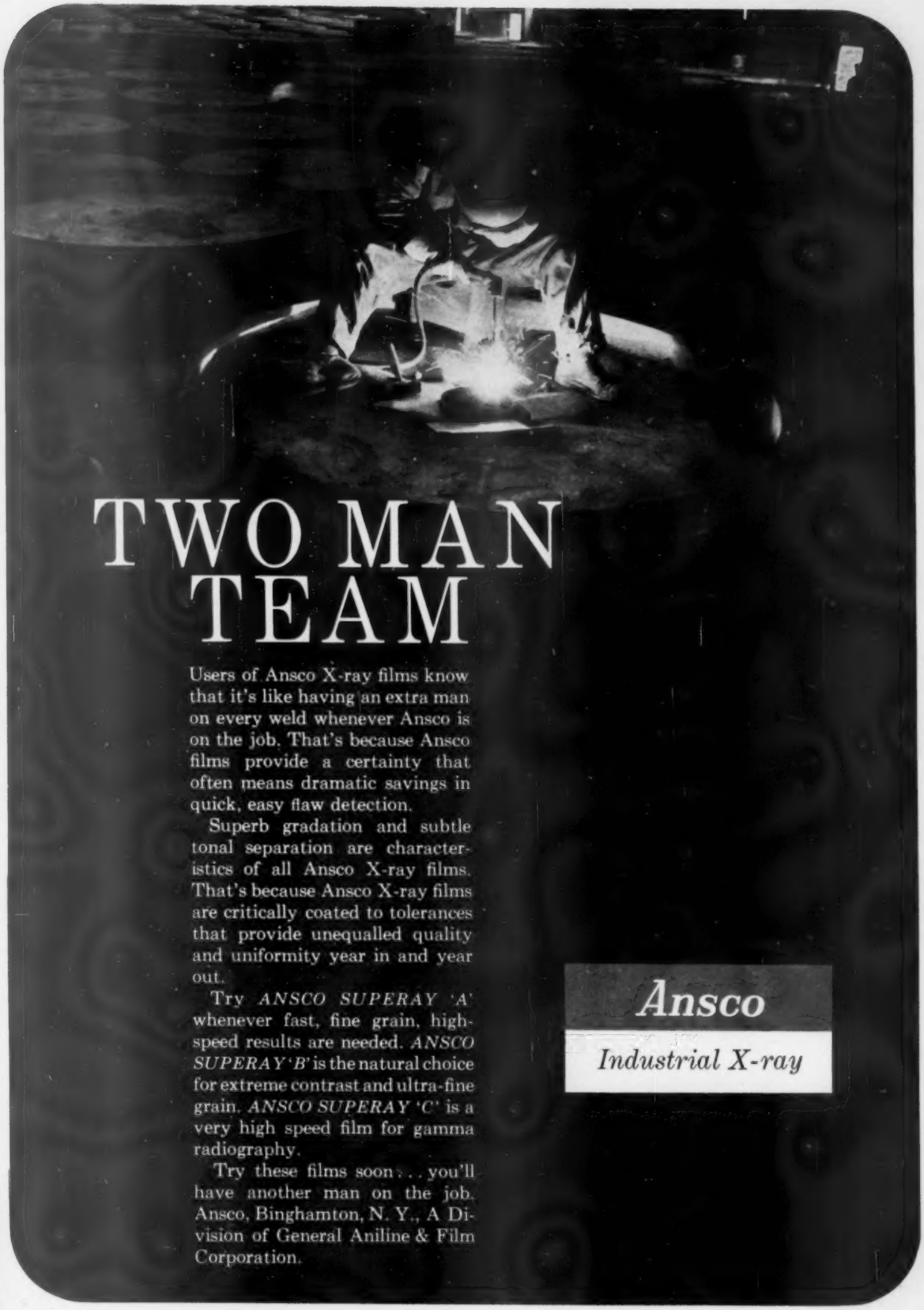
This electrical energy, expended in the slag and metal, becomes the medium through which heat is maintained for continuous fusion of welding wire. To keep energy dissipation consistent with thick plates, an automatic control creates a transverse motion, backward and forward, of the wire as it is fed into the slag. Or, for very thick plates, two or three wires can be fed simultaneously.

Electroslag equipment can handle plates from 1¼ to 14-in. thick. A ⅛-in. wire is normally used, this being either solid bare wire or composite wire for special purposes.

Penetration is controlled by the gap width and the voltage applied across the weld. Controls can pre-set voltage or vary it during welding.

Plate thickness (inches)	Distance between plate edges (inches)	Number of electrode wires	Spacing of electrodes (inches)	Transverse motion of electrode	Voltage	Current per electrode (amps)
1½-2	1.1-1.18	1	—	No	42-44	500-540
2½	1.1-1.18	1	—	No	42-44	500-540
3	1.1-1.18	1	—	Yes	44-46	540-560
4-5	1.15-1.22	1	—	Yes	44-46	550-580
4-5	1.15-1.22	2	2.5	No	44-46	550-580
6-7	1.18-1.26	2	2.75	Yes	45-48	600
8	1.18-1.32	2	3.15	Yes	46-50	600
10	1.18-1.32	2	3.15	Yes	48-52	620
10	1.18-1.32	3	2.55	No	48-52	620
12	1.18-1.32	3	3.5	Yes	48-52	640

TABLE shows variables used on typical welds with different thicknesses of material.



TWO MAN TEAM

Users of Ansco X-ray films know that it's like having an extra man on every weld whenever Ansco is on the job. That's because Ansco films provide a certainty that often means dramatic savings in quick, easy flaw detection.

Superb gradation and subtle tonal separation are characteristics of all Ansco X-ray films. That's because Ansco X-ray films are critically coated to tolerances that provide unequalled quality and uniformity year in and year out.

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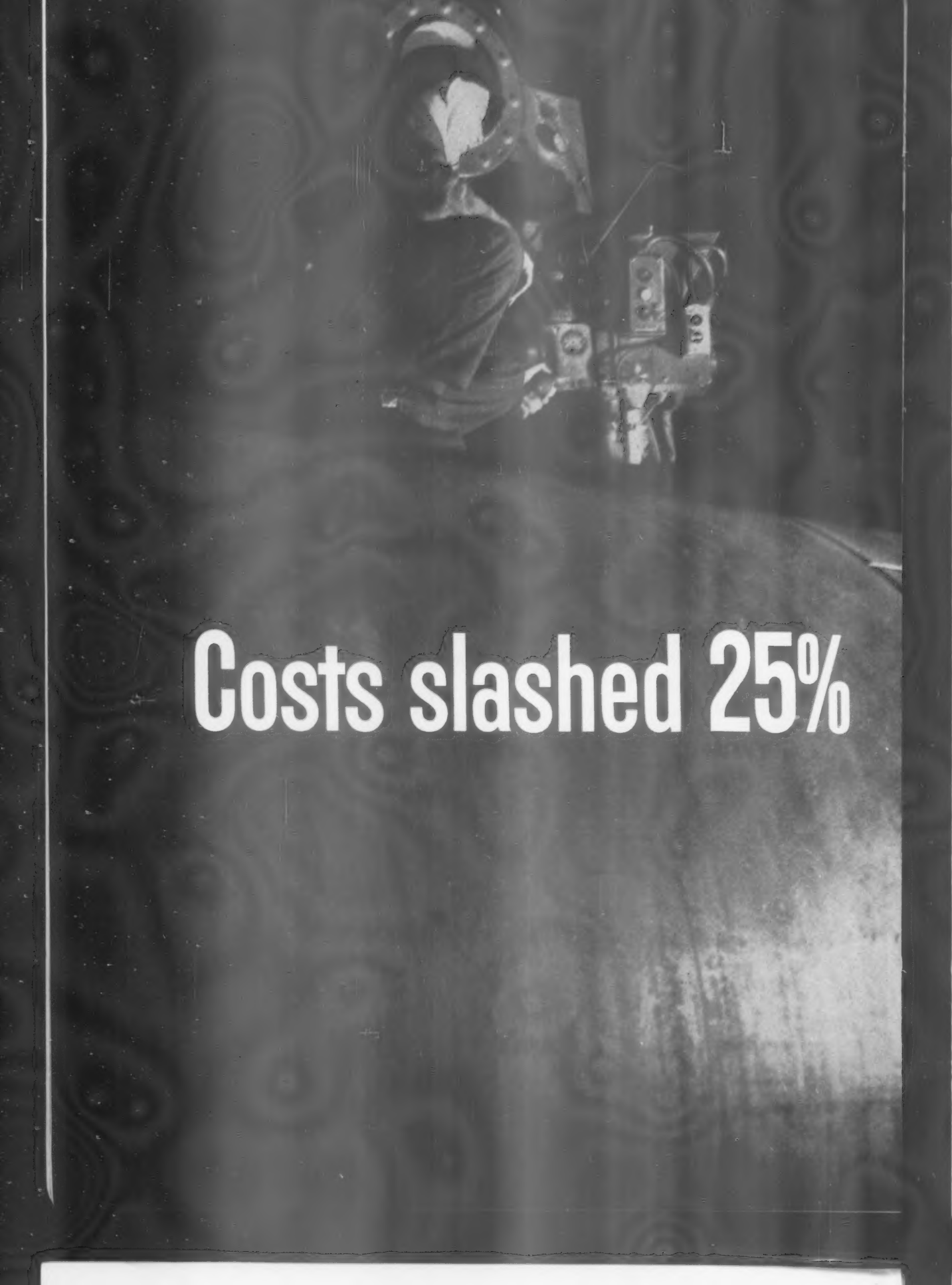
Try these films soon . . . you'll have another man on the job. Ansco, Binghamton, N. Y., A Division of General Aniline & Film Corporation.

Ansco

Industrial X-ray


Costs slashed 25%

Business is booming
at R & R Tank Company!
And now profits are rolling in.
Six months ago, welding costs
were twenty-five to thirty percent higher.
And the profit squeeze was tight.
But no longer!
New production methods
and faster, superior equipment
and electrodes turned the tide.
"How did we accomplish this?
The easiest way possible", says
Mr. Floyd Reinhardt, R & R's president.
"We called in the man who
knows most about welding procedures—
the Lincoln Welding Engineer.
"He suggested some easy changes
which were routine to him, I guess,
but they were news to us."

on tank production

RESULTS: A change in fabricating sequence
plus a switch to "Jetweld 1", iron-powder electrodes
saved 25% through faster welding and easier cleaning.
The three new "Lincolnweld" automatics
increased production and cut the
automatic welding costs by 30%.
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on your welding operations?
Call your Lincoln Welding Engineer today!

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OXWELD No. 24 Coverall Goggles have enlarged eyecups which fit over eyeglasses. They give *comfortable* eye protection with excellent visibility—minimizing eyestrain and fatigue during welding and cutting. Frames are lightweight, heat-resistant nylon plastic with vents around lens rings for full, non-fogging ventilation. The rigid metal bar permits goggles to be raised with one hand. The standard Type "AA" green filter lenses are available in Light, Medium, or Dark shades.

Oxweld GLOVES
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Made of tough, flame-resistant suede leather, these OXWELD Long Gauntlets are 13⅝" long to provide full protection for wrists and forearms as well as hands. They are unusually soft and comfortable.

See your LINDE supplier for prompt service and a complete line of job-proved, quality equipment and accessories for every oxy-acetylene welding and cutting need. Or write for his name and address to LINDE COMPANY, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y.

Linde TRADE-MARK
UNION CARBIDE

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Flame and torch when concrete block

A FIRM THAT HAS SUCCESSFULLY fabricated machinery for the rugged task of producing concrete block since 1904 is obviously the same type of firm that knows the value of welding and applied processes.

To both of these points, Besser Co. of Alpena, Mich., can answer "Aye."

The company's founder, Herman Besser, first purchased a hand-operated concrete block machine in 1897. It was intended for use as a sideline operation, for Besser was then manufacturing staves and shingles.

However, when Besser and other Alpena lumbermen formed the Alpena Portland Cement Co. in 1904, it seemed only logical to make the machines that make the blocks that make cement more readily useful.

Co-founder with Herman Besser of what was soon to become the Besser Co. was his son, Jesse, who has since served for many years as president of the company. A long-time designer of the firm's bigger and better machines, Jesse began his work at the drawing board and in the shop at a time when a hand-tamp machine operated by three men could turn out 200 blocks in a 10-hour day.

When the firm celebrated its golden anniversary four years ago, the concrete block industry was producing 2,000,000,000 blocks per year! And back-breaking manual labor was a thing of the past—thanks to vastly improved machines made possible by equally versatile welding and cutting methods.

Latest and best in the Besser line of concrete block machines is the Vibrapac, a unit which molds concrete into proper shape while the material is vibrated by two 10-hp motors and subjected to a pressure of 1,000 psi.

Preparing concrete for a pour into this molding machine is a job in itself, and is handled by Besser's 50 or 75-cu-ft-capacity Paddle Batch

mportant manufacturing machines

Mixer. On many components of this mixer—and particularly on the blades—manual metal-arc welding, flame-cutting and the arc-air process have found valuable applications.

Blades are cast from a Ni-Hard alloy that can be cut only with difficulty by oxyacetylene torches. Manufactured through a license with International Nickel Co., the alloy contains: 3.60% carbon; 0.45% manganese; 0.50% silicon; 2.20% chromium; 4.2% nickel; 0.11% phosphorus and 0.025% sulphur. It has a Brinell hardness of 600 to 650, and rates 58 to 60 on the Rockwell "C" scale.

Whenever risers on the cast blades were sledged off and broke "high" (i.e., broke at a point ¾ to 1½ in. above the blade body), the firm often spent as much as two hours grinding down the stub. The introduction of an arc-air torch, produced by Arcair Co., has put an end to this excessive time allotment.

The stub resulting from a very poor break can now be lopped-off by an arc-air torch in just 20 minutes. Average risers are handled in 15 minutes. Current needed for this job is 310 amp. Electrodes used are ¼-in. in diameter, and air pressure is 95 to 100 psi.

Use of the arc-air torch, however, has not eliminated the need for grinding wheels—it has simply left the abrasive tool with the type of job

OPERATOR uses grinder to finish mixer blade.

it does best: light stock removal and finishing. Where Besser once used three grinding wheels in one day, it now uses two grinding wheels in three days.

The wheels are ⅛ by 1 by ⅝ in. They are soft-grade type with a fine-grain silicon abrasive. Wheels are bonded with resinoid material, and have a fairly dense structure that gives a smooth finish.

In the shaping of many steel components for both Vibrapac and the batch mixers, Besser regularly employs flame-cutting. Repetitive parts that can be nested for economical cuts are handled by any of three automatic, multiple-torch flame-cutters used in the Alpena plant.

When these heavy plate forms are destined for use in areas where they will not have to be moved during later repairs or overhaul, manual metal-arc welding plays an extensive role in their fabrication. This process is also important in the assembly of smaller machine components.

ARC-AIR operation on blades of Paddle Batch Mixer.

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A telephone call to your nearby LINDE Distributor will bring you the benefits of more than 50 years of LINDE COMPANY's pioneering and leadership in welding and cutting. If you don't know your local LINDE Distributor, look in your classified telephone directory. Or write for further information to LINDE COMPANY, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N.Y. *In Canada:* Linde Company, Division of Union Carbide Canada Limited, Toronto.

Linde UNION CARBIDE

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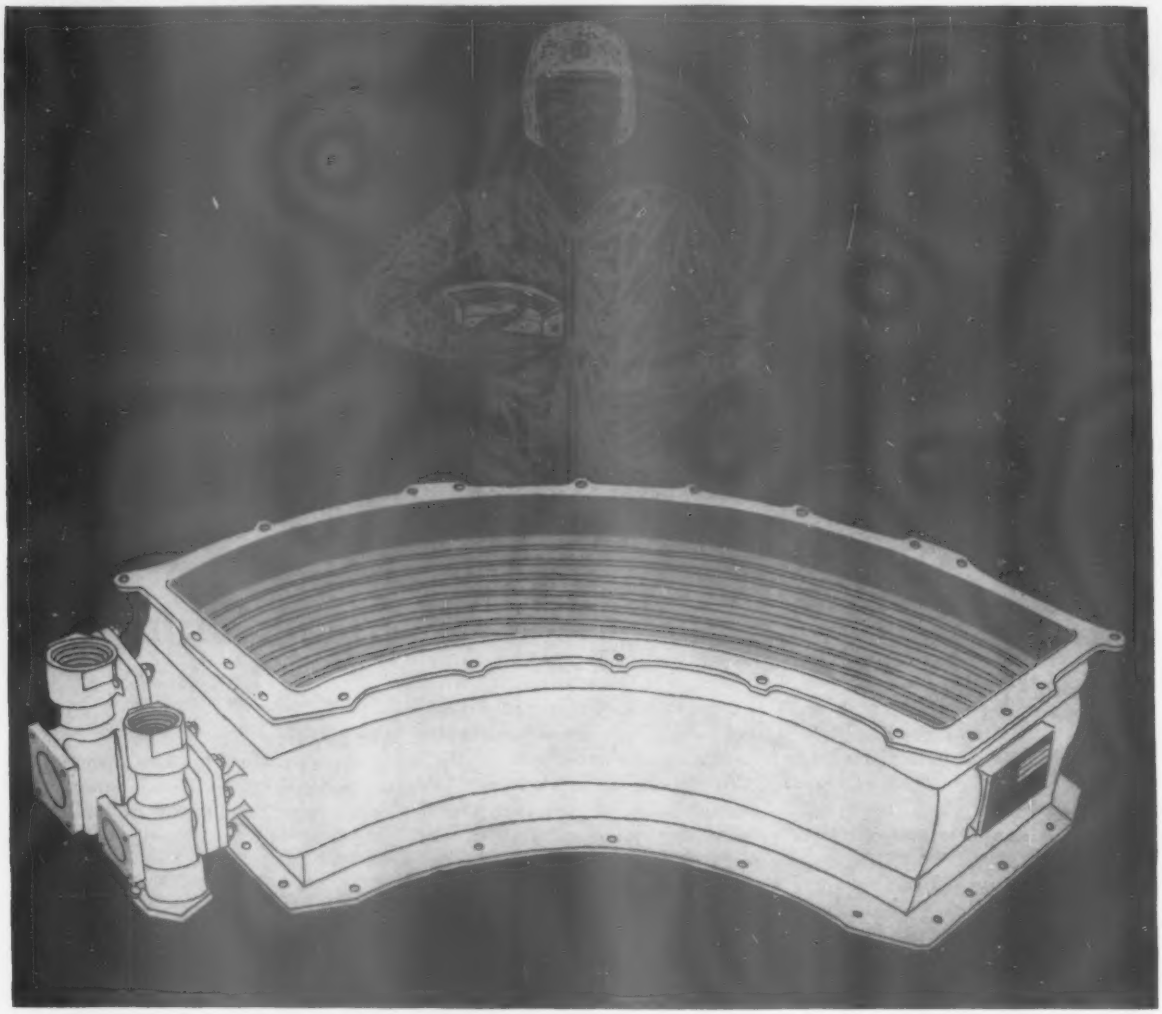
South Wind Division of Stewart-Warner Corporation builds this heat exchanger of Alcoa Aluminum. It is used in such high-performance aircraft as the Boeing B-52 jet bomber. Fins are die formed, separator plates blanked. Unit is then dip brazed to insure uniform quality, strong joints.



DIP-BRAZED ALCOA ALUMINUM HEAT EXCHANGERS GIVE JET-AGE PERFORMANCE, CUT JET-AGE COSTS

An engine oil cooler in a jet engine, often operating at supersonic speeds and stratospheric altitudes, has to be dependable. Joints or fins can't fail. To insure dependability, South Wind Division of Stewart-Warner Corporation builds oil coolers of dip-brazed Alcoa® Aluminum. The result is a strong, lightweight and easily fabricated unit that is produced economically and efficiently.

South Wind has also found that there are other good reasons for using the aluminum dip-brazing process. "We chose dip brazing because it yields the most consistent quality joint," says J. Q. Mosbarger, manager of South Wind's Sales and Engineering Administration. "We also prefer aluminum because it permits a heat exchanger design with 33 per cent less weight, it increases exchanger efficiency three to four times over its closest alternate metal. It is the most economical metal, pound for pound, we could use."

For heat exchangers or for similar applications, dip-brazed Alcoa Aluminum is the ideal solution because it produces complicated assemblies in one-piece, uniformly strong units. Closer tolerances in small parts are possible, and over-all strength can be easily controlled.

Any of the distributors listed at the right can give you full information on aluminum welding and brazing processes. Or, write Alcoa direct for free information and loan of films on joining aluminum. Write to Aluminum Company of America, 1761-G Alcoa Building, Pittsburgh 19, Pa.

ALCOA ALUMINUM

Your Guide to the Best in Aluminum Value

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Want technical help in welding, brazing or soldering aluminum? Contact your Alcoa sales office, listed under "Aluminum" in the Yellow Pages of your phone book.

For immediate delivery of Alcoa welding products, call your Alcoa outlet listed below. He carries a complete range of alloys and sizes.

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Hinkle Supply Co.

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Pacific Metals Company, Ltd.
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Pacific Metals Company, Ltd.

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Metal Goods Corp.

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Jacksonville
The J. M. Tull Metal & Supply Co., Inc.
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Atlanta
The J. M. Tull Metal & Supply Co., Inc.
Mid-South Oxygen Company

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Machinery & Welder Corp.
Steel Sales Corp.

KANSAS
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Metal Goods Corp.

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LOUISIANA
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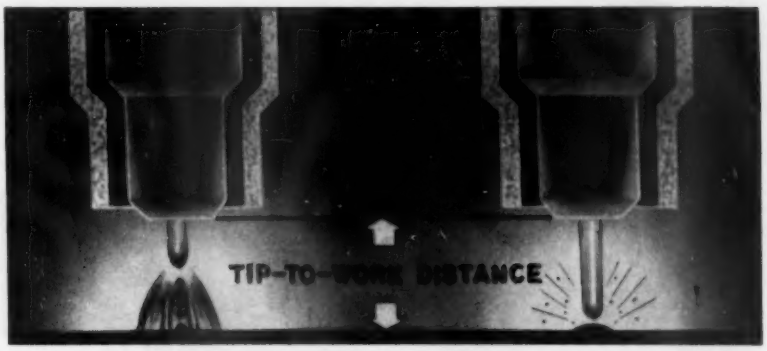

Spray-type arc (22-25 volts) Short Arc (14-19 volts)

Modified Mig method provides fusion welds on thin materials

MANUAL FUSION WELDS can be made on common metals ranging from 0.030 to 0.100-in. thick by using a modified Mig method called Short Arc. All types of joints can be made in all positions when carbon steel, stainless steel, aluminum (0.040-in. minimum), copper, etc., are welded with this new method.

Accurate control of weld puddle is provided by Short Arc, a development of Linde Co., when either manually or automatically welding thin materials.

The new method is also claimed to have advantages over other procedures for welding sheet metal. Short Arc is said to be easily controlled at high welding speeds, to produce fillet welds with little trouble, and to be able to weld sheet metal in a thickness range not formerly considered readily weldable by any process.

Successful operation of Short Arc depended on the development of a proper power source and selection of a suitable shielding gas.

Normal fusion welding operations using conventional power supplies with either covered electrodes or inert-gas shielded processes, give too much heat and cause uncontrolled melting when making butt, lap or fillet welds in thin gage material.

Short Arc uses a constant potential power supply incorporating a drooping characteristic. With this type of power supply, the surge currents can be controlled to limit the time duration of arc outages, prevent wire ejection, and produce a stable buzzing arc.

This arc, operating in the range of 30 to 125 amp, 14 to 19 volts, short circuits dozens of times per second. This produces a small cold puddle pinpointing location of arc heat and enabling welding of thin materials in all positions. It is used primarily with 0.030-in. diameter wire, although 0.020-in. diameter hard wire can be used on material in the very low end of the thickness range.

Argon is a suitable shielding gas for metals such as aluminum, copper and Everdur, while argon-oxygen and argon-carbon dioxide mixtures are finding wide acceptance when welding stainless steel and carbon steel.

Pure carbon dioxide is being used for some steel applications, but it produces somewhat more spatter and poorer bead formation than the mixtures.

The use of argon-carbon dioxide mixtures provides many advantages over either straight argon or carbon dioxide when joining carbon steel. The mixtures provide superior wetting action, with a minimum amount of deposited metal. This results in an excellent bead formation.

Another key factor in development of Short Arc was the devising of both manual and mechanized equipment to feed wires as small as 0.020 or 0.030-in. in diameter.

miller WELDERS

FIVE IN ONE

Fireball

Other Miller welders in this series include:

DA-300-L BIG RIG
Four-in-One:
AC arc welder; DC arc welder; 10 KW AC power plant; 1 KW DC while welding

D-250-L ROUSTABOUT
Three-in-One:
DC arc welder; 10 KW AC power plant; 1 KW DC while welding

D-250-W ROUGHNECK
Two-in-One:
DC arc welder; 1 KW DC while welding

Here's what makes this Miller model the "Five-in-One":

1. AC welder for metallic arc welding
2. DC welder for metallic arc welding
3. AC or DC welder for TIG welding
4. A 10 KW, 115/230v single phase 60 cycle power plant
5. 1 KW of DC while welding

The DAH-350-L Fireball, driven by Hercules 32 hp engine, is another Miller FIRST, offers both a-c and d-c for metallic arc or TIG welding with three separate a-c and d-c amperage ranges for each.

There's continuous high frequency for a-c TIG welding with choice of "start only" or constant high frequency for d-c TIG work.

Standard equipment includes built-in high frequency stabilizer, polarity switch, power supply for water coolant system, and automatic inert gas control panel with solenoid valve and post flow timer. Trailers are available for welder only or for welder with coolant system and gas cylinders.

SPECIFICATIONS

	Metallic Arc	Tungsten Arc
WELDING RANGE	35-100 Amps AC	35- 75 Amps AC
	65-160 Amps AC	65-160 Amps AC
	110-400 Amps AC	150-375 Amps AC
	35- 80 Amps DC	35-100 Amps DC
	75-175 Amps DC	85-225 Amps DC
	125-350 Amps DC	170-375 Amps DC
RATED OUTPUT	250 Amps Tungsten Arc, 100% Duty Cycle DC	
	300 Amps Tungsten Arc, 100% Duty Cycle AC	
CURRENT ADJUSTMENT STEPS	Infinite	
MAXIMUM O.C.V.	72 Volts DC	
	80 Volts AC	
1 KW DC AUXILIARY POWER	115 Volts	
AC GENERATOR OUTPUT	10 KW	
OUTPUT VOLTAGE	115/230 Volt, 1 Phase, 60 Cycle	

Complete specifications on these welders will be sent promptly upon request.

miller Electric Manufacturing Company, Inc., APPLETON, WISCONSIN

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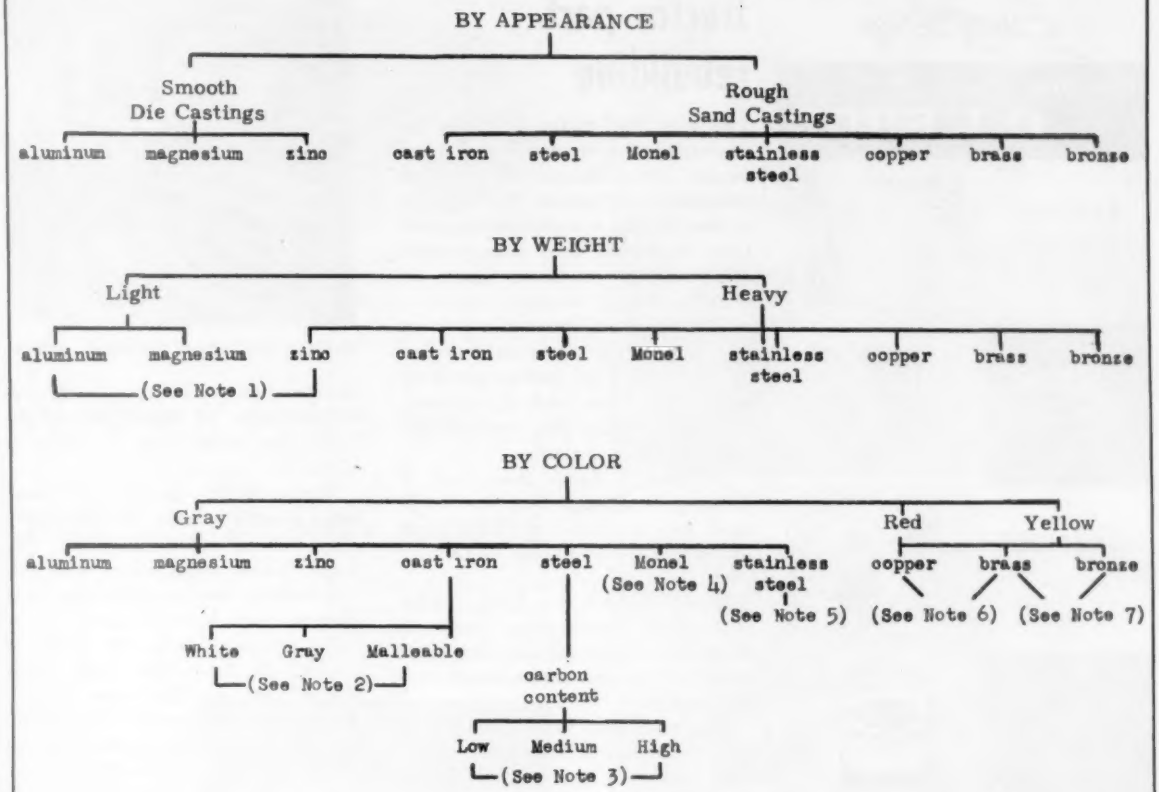
Identification of Cast Metals



by **Eric Holby**

BEFORE UNDERTAKING any welding job, a weldor should be sure he has identified the metal on which he will work. Until then, he cannot determine welding procedure.

Most materials are weldable, and though the weldor may not be familiar with joining of particular materials, he can readily find literature on the subject. Without this knowledge a weldor may pass up a job, resulting in thousands of dollars of readily repairable parts being scrapped.

Metals may be identified in many ways. In some cases, complicated chemical tests are necessary; other tests are relatively simple.

For example, using the above data, it is possible to identify most commercial materials by observing surface texture, weight and color.

Know the material you are welding. Once identified, it is a comparatively simple matter to obtain information to successfully complete the job.

Note 1—Zinc die castings weigh approximately the same as steel. Aluminum weighs 65% as much as zinc. Magnesium weighs only 25% as much as zinc. Zinc die castings are usually softest; magnesium, hardest.

Note 2—White cast iron may be distinguished from the other irons by testing with a file. White iron is very, very hard. Malleable iron is tough, and gray cast iron is quite soft. A sharp, cold chisel will help distinguish between these two.

Note 3—The carbon steels are easily separated by spark testing. See chart on spark testing, *WE* Data Sheet No. 4.

Note 4—Monel is a corrosion resistant material. Like steel, it becomes red before melting but melts more slowly. A heavy gray scum will appear on the surface of the molten puddle. Slag will be hard to break up and the metal will be fluid under the slag. The puddle lies quietly under the welding flame.

Note 5—Stainless steels are corrosion resistant and this is usually a good clue. Melt a puddle with a torch. If the puddle has a sandy surface appearance, then it is probably stainless steel. This sandy surface appearance occurs when stainless steel is melted without a protective coating of flux.

Note 6—Copper and red brass may be the same color but under the oxyacetylene flame the copper will form a clear quiet puddle while the red brass will smoke and give off zinc fumes.

Note 7—It is difficult to separate all the brasses and bronzes from one another. In general, the bronzes will be darker, richer in color. In any event, they may both be repaired by bronze welding.

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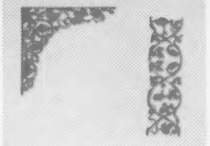
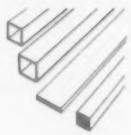


TUBING
From one tube to a mill lot.



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City_____ State_____

Twin wire feeds *speed* tractor part rebuilding

THE PAST FEW YEARS have seen the government allot more and more money for additional highways to criss-cross our nation. With the increase in road construction expenditures there has been a concurrent sales increase in tractor parts rebuilding shops.

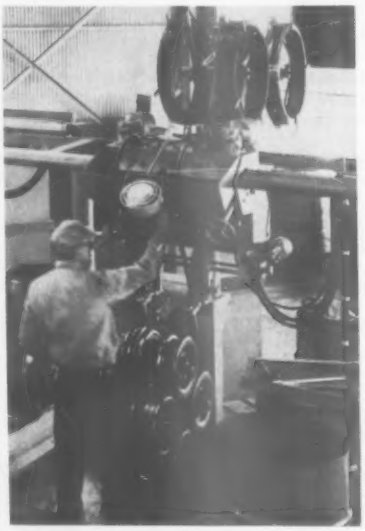
With more and more jobs pouring into the shops, workmen found it difficult to keep production speeds up to demand. This made it necessary for speedier rebuilding methods and machines to be devised.

A Berkeley, Calif., firm, L & B Welding Equipment Inc., has developed two machines to help boost production in rebuilding shops.

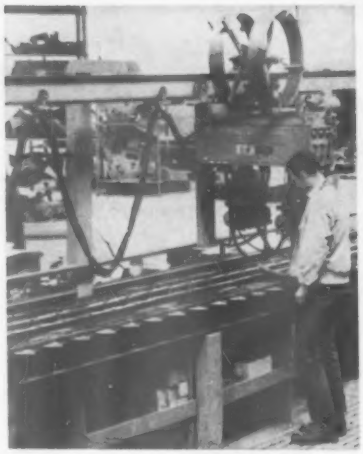
Model TLM-2 is a track welder of modular construction, featuring electronic controls, Twin Arc automatic wire feeders and a simple control station.

This track-link welder is said to have many advantages over single head, manually operated machines. The TLM-2 cuts overall welding time 55%, slashes set-up time from hours to minutes and provides uniform heat distribution, says the manufacturer.

The modular design allows additional lengths to be attached, and



MODEL DEMS roller rebuilder



MODEL TLM-2 track rebuilding machine.

enables two machines to be in different stages of rebuilding at one time. The central control station is simple to operate.

Model DEMS—double ended multiple spindle roller machine—has dual welding heads and Twin Arc feeds. It holds eight rollers, thus cutting loading time by eliminating handling of work between passes.

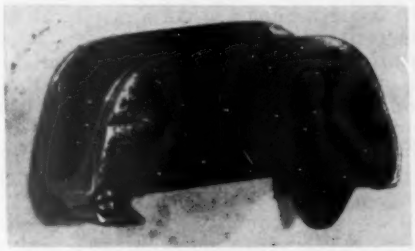
To rebuild rollers, the work is loaded, the two wire feeds positioned, and the dual arcs started. Then, an automatic indexing mechanism guides the wire feeders over the rollers to ensure a uniform bead.

When the first pass is completed, the next roller is moved into position, and the finished one allowed to cool. This operation is repeated until all rollers have been rebuilt to desired dimensions. A retractable shaft rotates only the roller being worked on.

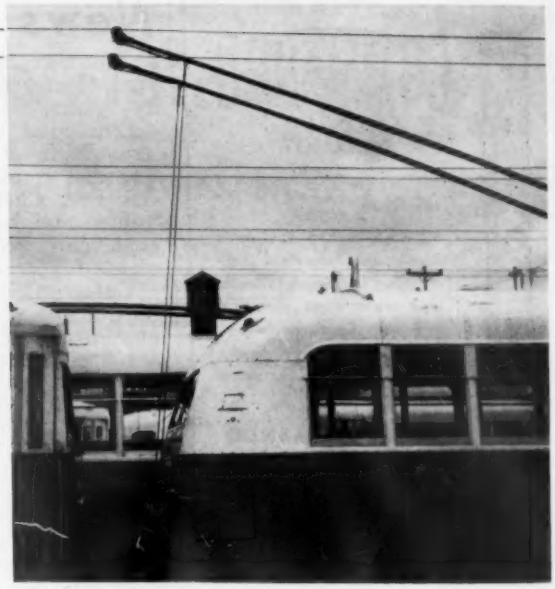
Both of the machines can be converted to handle idlers, with attachments available for the Model DEMS to rebuild crusher bars and other circular parts. This machine can also be adjusted to rebuild flanges.

A single console power source enclosing two d-c, constant voltage, 100% duty cycle welding machines was designed especially for use with both rebuilders. Their power requirements are: 60 amp, 440 volt, 3 phase; or 120 amp, 220 volt, 3 phase.

The electronic controls used by L & B are modular in design, with all circuits for a particular operation mounted on one frame. This enables a shop to choose only those controls needed to meet the requirements of a specific job.

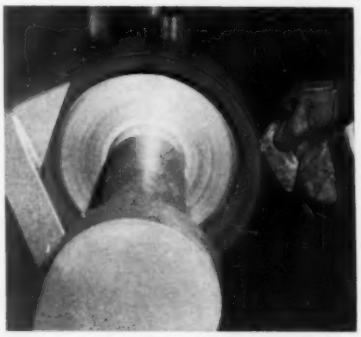


TROLLEY shoe (above) rides against lines and tops are worn rapidly by continual rubbing on wire "frog" switches.



Welding helps run Seattle's trolley buses

FILLER wire is placed on shoes' pre-machined edge (right) by weldor. After tacking and final welding, sharp edges (below) are rounded-off.



by **Herman C. Phelps**

CLANG, CLANG, clang went the trolley—and then the old-fashioned trolleys disappeared from the streets to be replaced with 306 trackless trolley buses by the Seattle Transit System.

The trolley buses each have two bronze shoes attached to poles riding against overhead lines. The shoes are easily removed by maintenance crews when worn to a pre-placed line provided by the manufacturer.

Seattle Transit has one of the most efficient maintenance operations in the transportation field. The company employs only two weldors, but according to F. L. Smith, assistant superintendent of equipment, they are the most important employees in the department.

The shoes are made of weldable bronze and have a carbon block inside which rides against the overhead wire. However, since these lines must have "frogs" for switching from one line to another, the bronze shoe tops are quickly worn by the continual rubbing.

Mileage per shoe cannot be accurately determined because of varying conditions, but in one year, more than 2,000 shoes have been rebuilt.

Build-up is done with a 3/16-in. diameter nickel-silver wire which has conductivity and hardness similar to the shoe's (100-125 Brinell hardness). The wire also has low arcing qualities, is easily ground, and is weldable with a low-amperage bronze electrode.

The weldor first places six shoes on their sides, then lays a short strip of the wire on the pre-machined edges. After tack-welding the wire to each end of the shoe, he turns it over and follows the same procedure on the other side.

When tacking is complete, the weldor then welds across the outside of both strips; sharp edges are rounded-off on grinders, and the shoe is ready for reuse.

The company feels welding maintenance has saved them untold thousands of dollars annually.

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DRILL KIT

- Lighter weight—made of aluminum
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Also available in liquid and pellet form . . . Write **Welding Sales Dept.** for sample TEMPIL° pellets . . . State temperatures of interest — please!

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News shorts . . .

Thermex Metallurgical, Inc., Lakehurst, N. J., which has been operating as a division of **Reade Mfg. Co.**, Jersey City, for the past 1½ years, has been made a separate corporation. It will carry on activities of the thermit-welding business which Reade acquired from **Metal & Thermit Corp.** in 1957 . . . A safety citation has been awarded employees of the Cicero, Ill., plant of **National Cylinder Gas Div., Chemetron Corp.**, for their record of more than half a million man-hours worked without a lost-time accident . . . Safety achievement awards were also won by 34 **Air Reduction Co., Inc.**, plants for working through 1958 without a lost-time mishap.

Eutectic Welding Alloys Corp., Flushing, L. I., N. Y. has moved its Chicago warehouse center from 1652 E. 87th to larger quarters at 4353 S. Kedzie Ave. . . . Three 16mm films on resistance welding are available on loan from the **Resistance Welder Manufacturers' Association**, 1900 Arch St., Philadelphia 3, Pa. . . . **Kaiser Aluminum & Chemical Corp.** will have an all-welded aluminum pilot boat for use in bauxite mining and shipping operations in Jamaica. **Higgins, Inc.**, New Orleans, will build it.

Linde Co.'s activities on the West Coast continue at a torrid pace. A liquid-hydrogen plant will be built at Torrance, Calif. Under terms of a recently awarded contract, Linde will supply the **National Aeronautics and Space Administration** with up to 3,300,000 pounds of the product per year. The firm's new plant at Pittsburg, Calif., is now on-stream, supplying missile manufacturers and other industries with liquid-oxygen. **Davis Welding Products, Inc.**, Portland, Ore., now has on its property a Linde 1,500,000-cu-ft storage tank for liquid oxygen; and **Arizona Welding Equipment Co.**, Phoenix, and **Aweco Supply Co.**, Tucson, have become Linde's sole distributors of gases in Arizona.

Cardox Div. of Chemetron Corp. has moved its offices from 307 N. Michigan to corporation headquarters at 840 N. Michigan Ave., Chicago. Cardox' district delivery and marketing depot for CO_2 remains at 43rd and Marshfield Sts. in that city . . . **Long Beach Welders Supply**, Long Beach, Calif., recently staged a successful equipment demonstration for its customers. Mal Teeter is president.

Construction has begun on **Air Reduction Pacific Co.'s** Richmond, Calif., plant, which, when finished late this year, will produce daily 30 tons of liquid oxygen, argon and nitrogen.

GREGORY CANNIZZO, managing editor of WELDING ENGINEER (center), receives from James Ball, public education chairman (right), The National Safety Council's Public Interest Award for 1958. Joe Bartulis (left), industrial safety chairman of Niles Township Safety Council, looks on. Publishing offices of *WE* are located within Niles (Ill.) Safety Council area.

ATOM·ARC* Pipe Welding Alloys

*IRON POWDER LOW HYDROGEN ELECTRODES

provide x-ray quality welds — lower welding costs at

NATIONAL VALVE AND MANUFACTURING CO.

less rework, no grinding or chipping, faster deposition rates, are time savers that boost profits.

Photos Courtesy NATIONAL VALVE & MANUFACTURING COMPANY

National Valve and Manufacturing Co., fabricator and erector of quality piping for American industry, has consistently been among the leaders in the piping industry for the last half century. This large, engineering-minded organization maintains its position of leadership through research to constantly improve methods and facilities—testing and selecting the latest in materials that will provide their clients with the finest quality high pressure, high temperature piping.

NAVCO research into welding techniques and materials resulted in the selection of ATOM·ARC All Position Iron Powder Low Hydrogen alloys for handwelding of pipe fabrications and for field erection. The X-ray quality of ATOM·ARC weld metal eliminates needless rework. The flat, smooth bead contour makes slag removal easy, requires no costly and time consuming chipping and grinding, allowing weldors more time for welding. Even finish grinding of the final pass is eliminated. These cost saving properties of ATOM·ARC electrodes are amplified by the fast deposition rate achieved from the iron powder type coatings.

These are the facts NAVCO found in their search for better materials for high quality piping . . . facts which prove ATOM·ARC Iron Powder Low Hydrogen Alloys produce superior piping products. For your free copy of an informative and revealing report to piping contractors, write to:

Alloy Rods Company, P. O. Box 1828, York 2, Penna.

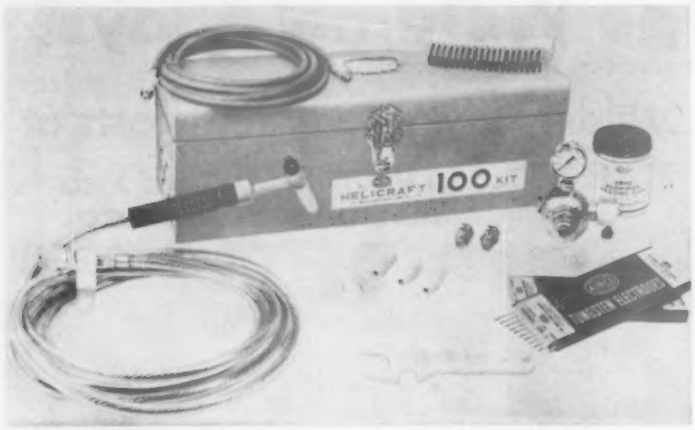
WORLD'S LARGEST SELECTION—IRON POWDER ALLOYS

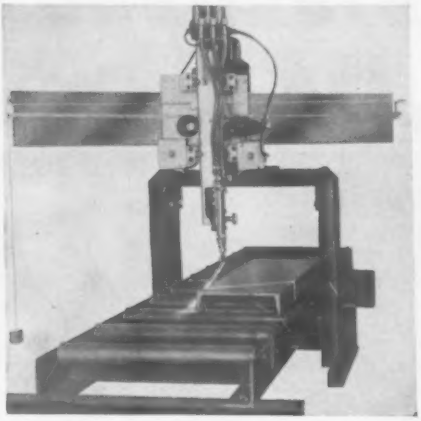
ATOM·ARC 7018 Mo	AWS E7018-A1
ATOM·ARC 8018 N	AWS E8018-C2
ATOM·ARC 8018 CM	AWS E8018-B2
ATOM·ARC 9018 CM	AWS E9018-B3
ATOM·ARC 10018 MM	AWS E10018-D2
ATOM·ARC 12018 NMV	AWS E12018-G
ATOM·ARC "Y"	AWS E11018-G
ATOM·ARC 502	AWS E502-16

Alloy Rods Company

YORK, PENNSYLVANIA • EL SEGUNDO, CALIFORNIA

NO FINER ELECTRODES MADE . . . ANYWHERE





Low-price Tig outfit

Tig outfit, Helicraft 100, may be operated from any conventional d-c power source. Packaged in steel carrying case, the kit includes new-type fixed-flow pressure regulator with flow adapters. Manufacturer says it will produce quality welds on light-gage stainless steel, aluminum, brass, copper, nickel, silver and other non-ferrous metals. Priced below $100. *Air Reduction Sales Co.*

Circle No. 1

Arc welders

New Saturn-Hivolt arc welding machines Mk II and Mk III, operating on the surge injection principle, are said to offer many advantages in the operation of this well-known process. A d-c suppressor unit, which gives a completely symmetrical arc, is fitted to this equipment. Unit operates with a 42-volt transformer; control of gas and arc is entirely automatic. *Saturn Metallurgical Co.*

Circle No. 2

Finishing material

Scotch-Brite brand finishing material is made of nylon web impregnated with fine grades of abrasive material. It is not intended for stock removal. Material comes in disc form, each disc being about ¼-in. thick. Finish generated by this product is said to be unique, when used on stainless steel, aluminum and other metals. Stainless steel producers report that Scotch-Brite markedly increases line speed along the pickling line. Five diameters of discs are available, from 6 to 14-in. size. *Minnesota Mining & Mfg. Co.*

Circle No. 3

Welding control

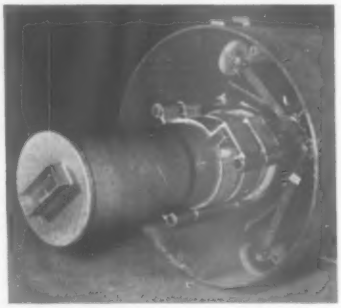
An instrument control sequencing interlock is available with capabilities and sizes for any spot-welding application. It has been installed in shops with as few as five single resistance welders, and in very large automotive plants. Instrument control permits operation of the maximum possible number of welders simultaneously without overloading plant power supply, and eliminates the possibility of bad welds caused by voltage drops. Equipment is entirely electronic and can monitor as many as 25 welding presses in a scanning time of a few thousandths of a second. *Instrument Control Co.*

Circle No. 4

Nickel-base alloy

Hastelloy alloy N, a container material for molten fluoride salts, is now being produced on a developmental basis. Alloy N has good weldability and can be readily forged; hot-working range is between 1,600 and 2,150 F. It has been extruded and produced as high-quality seamless and welded tubing. This alloy can be supplied, to order, in the forms of sheet, plate, bar, wire, coated welding electrodes, etc. *Haynes Stellite Co.*

Circle No. 5



Radiograph unit

Travel-Ray machine uses X-ray tube of patented design, which projects only a narrow beam of parallel rays. Permits radiography of longitudinal welds while X-ray source is in motion. Manufacturer claims this is the first practical method of radiographing every inch of every weld—longitudinal and circumferential—at rapid rates. Equipment is easily adjustable for pipe diameters from 12 through 36 in. It features special 6 and 12-wheel drive crawlers, and offers variable band width, speed and power up to 250 kv. *Travel-Ray Corp.*

Circle No. 6

Shape cutter

Structural Shape Cutter has many engineering features that reduce handling, layout and cutting time on structural shapes, such as I-beams, H-beams, angles, channels, bars and plates. Two independently operated variable-speed motors activate the horizontal and vertical geared tracks to insure a smooth, steady cut. Constant heat is achieved by solenoid valves which coordinate the gas and oxygen at the burning tip. *Steffan Mfg. Corp.*

Circle No. 7

Plastic-coated gloves

Plastifab gloves are coated with a blend of plastic resins and plasticizers to provide abrasion resistance, flexibility and long wear. Especially recommended for handling of greasy, oily or other slippery objects. All gloves have 8-oz jersey lining. *American Optical Co.*

Circle No. 8

Zirconium-copper alloy

New, versatile material known as Amzirc alloy consists of high-conductivity, oxygen-free copper and carefully controlled concentrations of high purity zirconium. Among applications, where the new alloy is well suited, are resistance-welding wheels and tips. High softening temperature of Amzirc alloy permits welding, brazing and silver soldering. *American Metal Climax Inc.*

Circle No. 9

Flaw detector

Ultrasonic test instrument, Sonoray model 5, is said to offer simplified operation, convenient size and weight. Variations in the oscilloscope trace pattern indicate a flaw of discontinuity, by means of the pulse-echo detection principle. Instrument can be used for contact or immersion work. Unit is easily carried by one man. *Branson Instruments, Inc.*

Circle No. 10

New design in Sigma hand welding torches

Here is a new, lightweight torch—only 16 ounces—for manually welding light-gage steels. Sigma ST-2 welds in all positions with no change in control or current settings. Welds .030- to .100-in. sheet, using low-voltage short-arc technique with .020- and .030-in. hard-drawn wire. For 200 amp continuous service, a-c or d-c.

Balanced design makes handling easy. Service lines enter through rear of handle—a convenience in cramped quarters. Start-stop switch on handle, easy to reach. Nozzle has a 60° curve for maximum weld visibility.

Sigma ST-2 makes high-quality welds at high speed. Seams require no cleaning . . . distortion is at a minimum. Inert gas shielding is economical. Low flow rate—only 10 cu. ft. or less per hour—means even more savings.

Call your nearest LINDE office today for a demonstration of this new Sigma ST-2 torch! Or write Dept. LINDE COMPANY, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N.Y. Offices in other principal cities. In Canada: Linde Company, Division of Union Carbide Canada Limited.

Linde TRADE-MARK UNION CARBIDE

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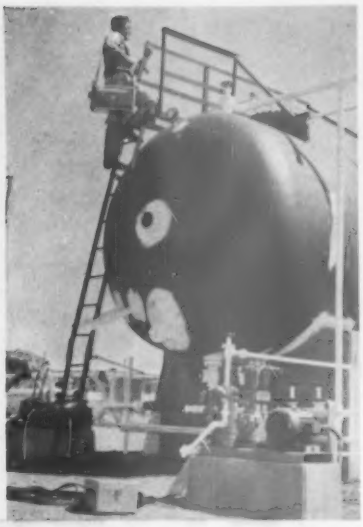


X-ray unit

Portable X-ray weldment inspection equipment, LX-140, makes possible easy field inspection of tanks, pipes and structures. New unit will operate in temperatures from 0 to 120 F, and at altitudes to 5,000 ft, always providing effective radiation protection. The LX-140 offers a continuous range of 70 to 140 kvp. X-ray and control units weigh only 71½ lb. *General Electric Co., X-ray Dept.*

Circle No. 11

Shearing machine

Metlmastr TE-281 is a new model shearing, forming and piercing machine. It has maximum edge-cutting capacity of 9/32-in. in mild steel plate, and 3/16-in. in stainless steel. Throat depth is 49¼ in., which permits circle cutting up to 48-in. diameter inside the throat. It cuts straight, circular, inside or irregular shapes, slots and louvers, as well as performing beading, planishing, flanging, edge bending, joggling, nibbling and hole piercing operations. It has a shipping weight of 3,600 lb. *Lennox Tool & Machine Builders*

Circle No. 12

Scale removal

Portable, lightweight electric applicator unit was developed for application of Ox-Off 536 to large assemblies, which cannot be immersed in heated bath. All welding scale and oxidation, it is claimed, are removed with a few strokes of hand applicator. Unit operates from any standard a-c source. *Chemclean Products Corp.*

Circle No. 13

Atmosphere systems

Controlled atmosphere chambers reduce contamination to less than one part per million without wasteful inert gas flushing. Standard models have vacuum systems that can reduce chamber pressures to less than 1×10^{-4} mm Hg, before introduction of uncontaminated atmosphere. Chambers are of stainless steel; a full-view Plexiglass dome provides maximum visibility. Ultimate vacuums of 5×10^{-4} can be reached within 20 minutes. *Scientific Engineering Labs.*

Circle No. 14

Wider alloy sheets

Wider cold rolled, thin-gage, high temperature alloy sheets are now available. More applications of the new large thin sheet for space craft, conventional jet aircraft, etc., are now possible. Wrought alloy sheets are now being rolled with dimensions 0.010-in. thick, 36-in. wide, and 96-in. long. Alloys now available in this form are: Haynes alloy No. 25, Multimet alloy, Hastelloy alloy R-235, Hastelloy alloy X, and General Electric's Rene-41 alloy. These are among the leading materials in high-temperature metallurgy. *Haynes Stellite Co.*

Circle No. 15

Automatic pipe welder

New automatic welding machine is said to be the first capable of producing sound welds with full penetration, without use of back-up rings. This gain in aluminum pipe welding technique, plus ability to complete a pass on 4-in. pipe in 11 seconds, cuts costs considerably. New consumable electrode welding machine is designed to simplify maintenance requirements. Electronic tubes have been replaced by extensive use of magnetic amplifiers and semi-conductors. All electronic components are off-the-shelf items. *Aluminum Co. of America.*

Circle No. 16

Columbium alloys

Series of columbium base alloys are now available in ingots, forgings, bar, rod, plate, sheet and fabricated parts. Fansteel 80 is a columbium-zirconium alloy with 4,350 F melting point. Fansteel 82 is of columbium-tantalum-zirconium, with melting point of 4,550 F. Both are easily fabricated at room temperature, either in as-worked or annealed state. Both have excellent weldability with ductile welds and little or no tendency to fracture in the heat affected zones. *Fansteel Metallurgical Corp.*

Circle No. 17

A-c/d-c welder

Latest Miller model, Big Twin, is a 250 amp. a-c/d-c transformer-rectifier type welder. It has a-c ranges of 20-125 and 60-290; d-c spreads of 18-100 and 65-290. Rated output for both types of current is 250 amp at 30 volts on 40% duty cycle, or 200 amp at 40 volts on 60% duty cycle. New movable shunt-type transformer allows fine current adjustments. Exclusive semi-metallic rectifier stack qualifies this welder for every production line requirement, manufacturer says. Compact only 25½-in-high. *Miller Electric Mfg. Co., Inc.*

Circle No. 18

Wheels and brushes

Line of Skil wire wheels and cup brushes will be helpful to aluminum and steel casting manufacturers, and anyone who finishes, cleans or polishes metal products. All Skil Cup Brushes have a ⅝-in. by 11-in. thread arbor. Wire wheel brushes are furnished with popular size arbor adapters. *Skil Corp.*

Circle No. 19

Eddy current testing

Transistorized instrument measures and sorts monmagnetic metals. Magnatest FM-110 conductivity meter is flashlight-battery powered, and induces eddy currents within the test piece by means of hand-held probe. Instrument may also be used to determine hardness, alloy and heat treat condition; to check tensile strength of aluminum, etc. *Magnaflux Corp.*

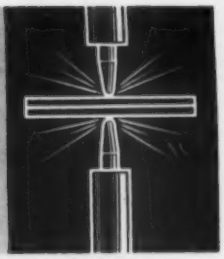
Circle No. 20

P.R. MALLORY & CO. Inc.

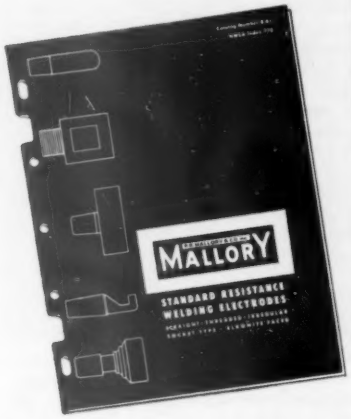
MALLORY MEMOS

NEWS AND TIPS ON RESISTANCE WELDING

P. R. Mallory & Co. Inc., Indianapolis 6, Indiana



WELDING HINTS



What's the best combination of electrodes for spot welding your particular combination of metals? You'll find the answers . . . and a lot of other facts useful to you in the latest Mallory catalog, STANDARD RESISTANCE WELDING ELECTRODES. For example:

Welding *aluminum 2S and magnesium*

Weldability is good when Elkaloy A electrodes are used.

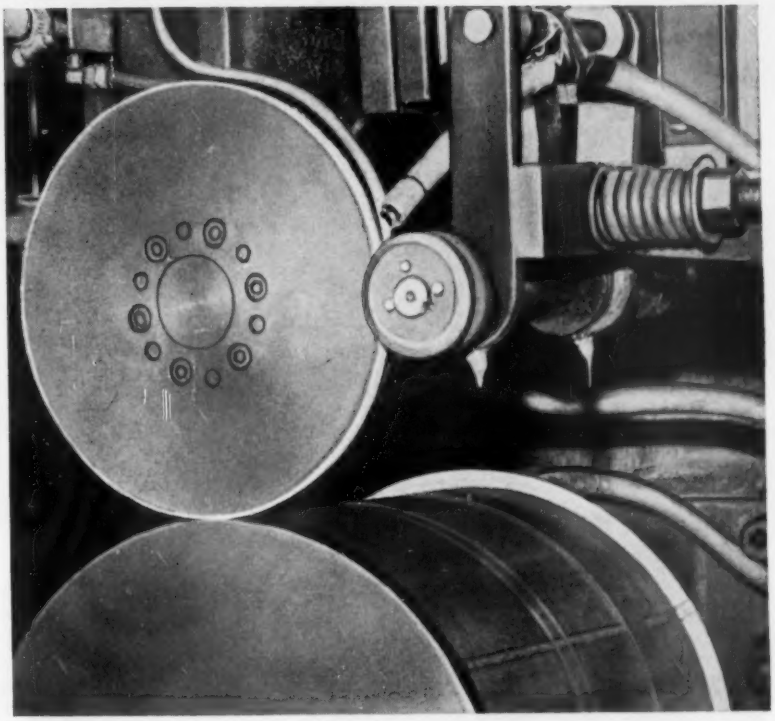
Good weld strength results when welding conditions are accurately controlled.

Welding *Stainless Steel to Stainless Steel*

Use Mallory 100.

Results are excellent; weld strength is good.

A chart in the catalog gives you recommendations for welding over 50 different metals. The catalog also gives properties of Mallory alloys, complete dimensions of various types of standard Mallory electrodes, including irregular welding electrodes. Write for your copy.



Seam Welding Costs Less With MALLORY Wheels

Here's a way to get welding wheels for the right job at the right price. When heavy duty is required, use Mallory cold-forged wheels. They're made through special Mallory forging techniques that give unexcelled uniformity, conductivity and hardness. Produced from a variety of alloys, Mallory cold-forged wheels give consistently fine welds on stainless steel and other special materials and long service between dressings. For less demanding jobs, Mallory offers a line of economy-priced welding wheels. They're constructed of Mallory 3® Metal for top performance.

Both heavy duty and normal duty wheels are available as rough forgings or finish-machined to your specifications.

Mallory welding products are available from authorized distributors located in all principal cities.

FOR ANY STAINLESS WELDING JOB

Drawalloy
CORPORATION

Stainless Steel Welding Wire

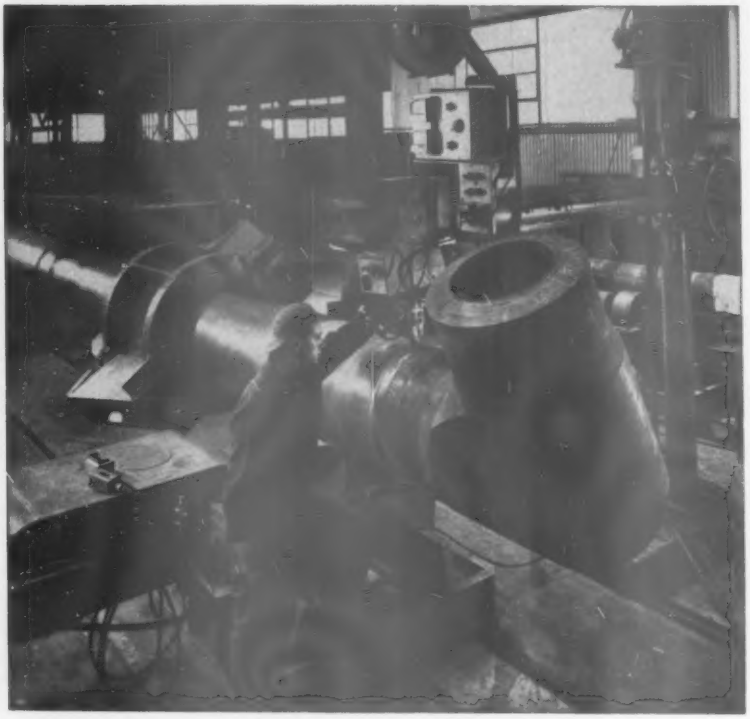
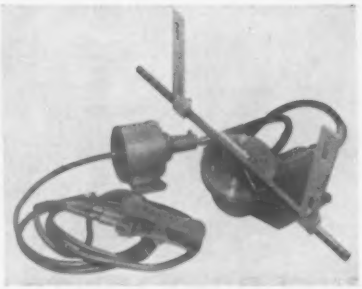


Photo courtesy of National Valve and Manufacturing Co., Pittsburgh, Pa.

Specify Drawalloy "quality controlled" stainless steel welding wire for *your* next "quality weldments." Your greatest advantage is experience . . . our experience in producing wires for welding exclusively. Because we are specialists, Drawalloy stainless steel welding wire is produced to strictly controlled specifications to provide the right chemistry, finish and temper for the finest quality weld metal and smoother operation in your automatic or semi-automatic equipment. Drawalloy stainless wires are available in all popular grades as well as 2¼ Cr, 1 Mo; 1¼ Cr, ½ Mo.

Why not discuss your stainless welding wire needs with your Drawalloy Distributor or Representative . . . a man with the products and knowledge to help you. Bulletin 355 DC provides complete information on every grade of Drawalloy wire. Write to: Drawalloy Corporation, Lincoln Highway West at Alloy Street, York 12, Penna.

DRAWALLOY
CORPORATION
STAINLESS STEEL & TOOL STEEL WELDING WIRE
THE WIRE MILL FOR THE WELDING INDUSTRY



Hydraulic positioner

Called PowRarm No. 396, this new unit, rated at 500-lb capacity, consists of a heavy duty Wilton Hydraulic PowRarm connected to an air-hydraulic booster. Unit is activated by means of foot pedal or hand control, operated from the factory air supply. The instant control is touched, workpiece is released or locked in position, as the operator chooses. No. 396 is widely used for heavy assembly work and compound angle drilling. Other models range in capacity from 6 oz. to 1,000 lb. *Wilton Tool Mfg. Co., Inc.*

Circle No. 21

Cutting coolant

Chemical in nature, cool-blue coolant concentrate will not turn rancid nor support bacterial growth. Campbelline coolant contains an effective deodorant and was formulated for use with all makes of abrasive cutting machines and most grinding operations. Under normal working conditions, it should be used as one part coolant to 150 parts of water. Product is available in 1-gal cans, 5-gal pails, 14-gal quarter-drums, and 55-gal drums. *Allison-Campbell Div.*

Circle No. 22

Ultrasonic welder

Instrument-type ultrasonic welder is designed to make welds on small parts and delicate assemblies. Sonoweld W-100-TSL-58-6 has power capacity of 100 watts. Since no electrical current passes through the parts being joined, contamination of surrounding areas is eliminated. Large number of dissimilar metal combinations can be joined successfully. *Aeroprojects Incorporated*

Circle No. 23

Some things are PRICELESS

To a drowning man nothing is more valuable than a life preserver. Every day, in thousands of shops, EUTECTIC "Low Temperature Welding Alloys" ® are just such a "Life Saver".

In maintenance shops from coast-to-coast, and throughout the world, weldors have learned to rely on EUTECTIC products. They don't count the cost of these Priceless Alloys because they know what they will do. They know that every package carries a guarantee of satisfaction, of competent service from each of 300 qualified Technical Representatives. They depend on prompt delivery of factory-fresh products, from modern warehouses, in major centers throughout the country.

You, too, can profit from 50 years of research and development by calling your nearest EUTECTIC Representative. Without obligation, he will conduct a Weld Savings Survey in your shop or plant, carry out a complete product demonstration keyed to your products and problems, and provide you with valuable technical data that will find daily use in solving your toughest welding problems.

You owe it to yourself to get all the facts on EUTECTIC low heat input welding that minimizes warping and distortion and produces joints that are often stronger than the original part. Fill out the handy coupon now and learn how you too can make tremendous savings through the use of the Priceless Hundred and Sixty EUTECTIC "Low Temperature Welding Alloys".

EUTECTIC Guarantee of Satisfaction

Cost plays no part in the selection of raw materials for the manufacture of EUTECTIC "Low Temperature Welding Alloys". Only the finest ingredients are acceptable and each product is reformulated regularly to take advantage of the latest research in product development.

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Warehouses and Service Centers in ATLANTA; BOSTON; CHICAGO; COLUMBUS, OHIO; DALLAS; DETROIT; LOS ANGELES; ST. LOUIS; SEATTLE.

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Gentlemen:

Please send my free copy of the 180-page EUTECTIC Welding Data Book.

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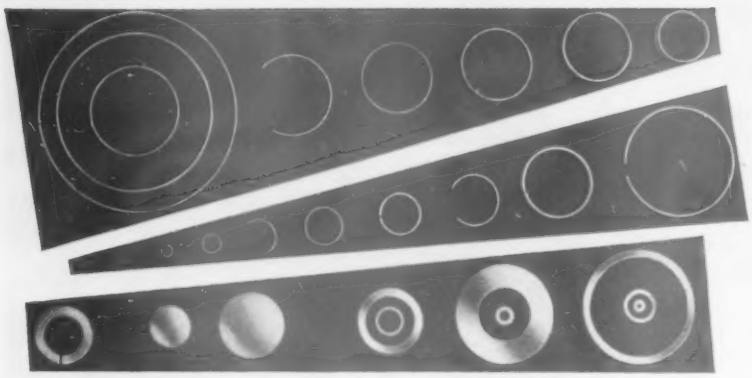

Pre-formed for your needs

GB *PRE-FORMED* Silver Brazing Alloys are available in the size and shape your job requires. Pre-formed shapes, like those shown, are designed for the joint. They assure strong, safe connections with a measured, minimum amount of alloy to save you time and money.

Write today for facts about efficient, economical GB 88 Flux and GB Silver Brazing Alloys in random coils, strip, pre-formed rings or special shapes.

Dealer Distributor Inquiries Invited

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GB Goldsmith Bros. SMELTING & REFINING CO. Est. 1867

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A MEASURED AMOUNT OF SILVER BRAZING ALLOY WILL PRODUCE A BETTER LOOKING AND MORE COST CONTROLLED JOINT.

Semiautomatic welder

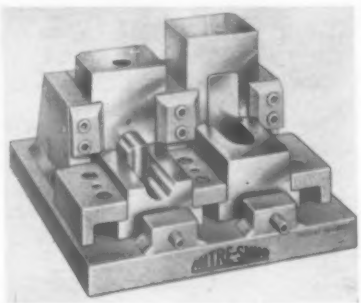
Amsco semiautomatic welder is connected to any 300-amp or larger d-c power source and feeds hardfacing wire through a hand-held electrode holder, whenever holder switch is depressed. Designed for build-up and hardfacing on dipper teeth, dipper lips and other parts that cannot be handled with fully automatic equipment. *American Manganese Steel Div.*

Circle No. 24

Production welder

Electrically heated air welder, for plastics, Model 10-HS, is for high speed production, repair and maintenance. Special tips hold and guide rod automatically. Calrod-type heating element is used. Disassembly is accomplished by turning single annular nut. The Kamlar complete kit includes 16-ft of heavy duty hose and electric cable, pressure gage, air flow regulator, one tip for ⅛ and 5/32-in. welding rod, and larger tip for 3/16-in. welding rod. *Laramy Products Co.*

Circle No. 25



Tube mitre

Unit called Mitre-Snug produces close-fitting, true-mitre joints that can be brazed or induction welded without the need for filing or deburring. It will mitre both round and square tubing, including pre-formed shapes. Provides for interchange of punches and dies of various sizes and cutting angles. *Vogel Tool & Die Corp.*

Circle No. 26

Plier-type clamp

By pressing trigger against either upper or lower handle, manufacturer says clamping operations are made easy in hard-to-reach positions. Patented two-way trigger release makes one-hand operation possible. New De-Sta-Co clamp comes in variety of sizes with jaw openings to 6-in., and holding pressure capacities to 1,200 lb. *Detroit Stamping Co.*

Circle No. 27

Electron-beam welder

Model 2770 welder is highly flexible laboratory and light production unit, in the $12-$14,000 range complete with all power supplies and three-motion work-positioning table. Beam of high-energy electrons is directed on the work from special NRC gun at the top of welding chamber. Maximum welding speed is ½ in. per sec longitudinally. *NRC Equipment Corp.*

Circle No. 28

Eye rinse bottle

Effective and safe in rinsing for both slight and severe chemical burns, Eye-Bath-Bottles are inexpensive compared to eye-wash fountains, manufacturer says. More than one of these bottles can be kept throughout a plant where they are easily accessible. Bottles are easy to clean, unbreakable, and convenient to use in any position. *Advance Glove Manufacturing Co.*

Circle No. 29

Solder dispenser

A solution to problem of accurate dispensing of two-component epoxy solders has been achieved. One roller-key extends across both tubes of TwinWeld, a two-component epoxy solder; thus equal quantities of each of the two materials are ejected each time. TwinWeld can be cast, laminated, shaped, drilled, sawed, sanded, or finished like metal. Said to be dimensionally and chemically stable, the solder does not dry out out in tube. *Fybrglas Industries*

Circle No. 30

Do YOUR welding helmets help produce more and better welding?

YES!...they do if they're Fibre-Metal's

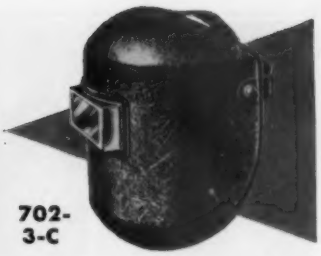
FIBERGLAS* WELDING HELMETS

Undeniable comfort, clearest wide vision and assured safety are basic quality features of these Fiberglas welding helmets. FIBRE-METAL compression-molded, Fiberglas-reinforced polyester resin shells offer the very finest in durable face protection. Proper glass fiber distribution and a "beaded edge for strength" insure long-lasting, trouble-free helmet life. Shells are self-extinguishing, are unaffected by heat and moisture, will not warp or lose shape, may be easily and quickly cleaned and sterilized. *Welders TELL US these helmets help produce more and better welding!*

All helmets have Ratchet Adjustment "free floating" Headgear, impact resistant adjustable friction joints and adjustable chin rest. Glassholders are available in plastic, steel or Dowmetal, in either fixed or lift-front styles. All types of helmets are described in Catalog No. 26.

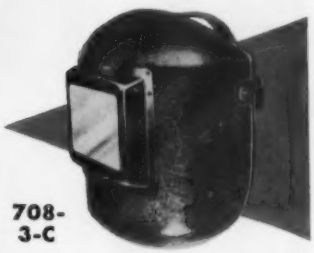
Ask your Welding & Safety Distributor!

*OWENS-CORNING TRADE MARK



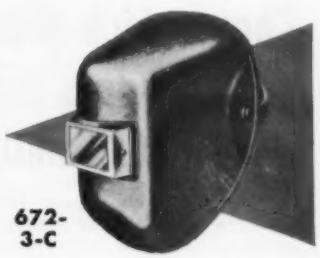
702-3-C

This is a popular standard-size Helmet that offers excellent fume and light seal with extra ventilation. Has all the famous Fibre-Metal comfort features. Offers variety of fixed and lift-front glassholders.



708-3-C

Over 120% increased vision with its 4½" x 5¼" lens...more vision both vertically and horizontally. Reduces eyestrain and fatigue. Excellent for welders who must wear bifocals, or trifocals, while welding.



672-3-C

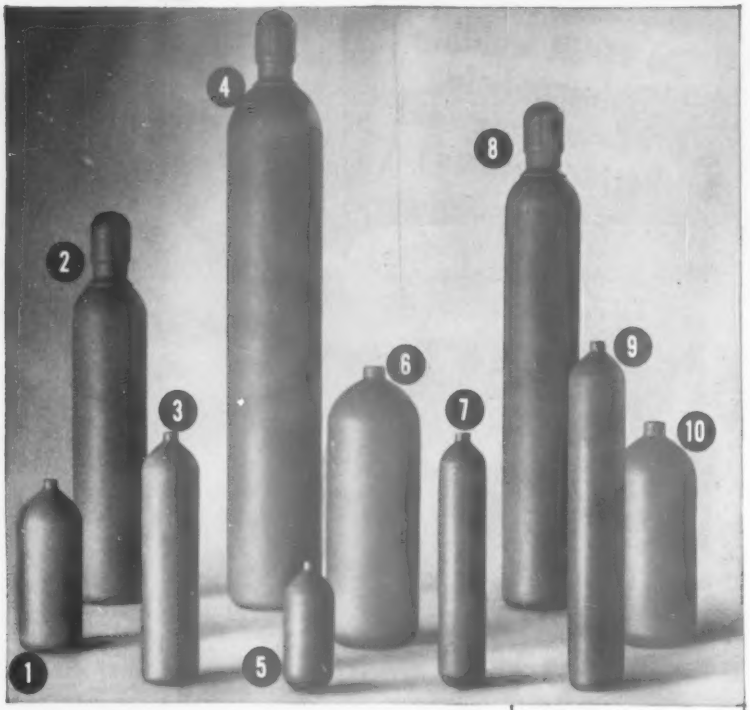
The popular narrow-front shell for compact, lightweight protection. Best for welding in tight spots...eliminates flat, spatter-collecting surfaces. Less pitting, lasts longer. 674-3-C has lift-front glassholder.

606-3-C

Features extended neck and chest protection with greater ventilation. Standard-size shell. Also available with an Inner Bib *(See our Catalog No. 26)* for extra fume and light seal.

The FIBRE-METAL Products Company | CHESTER PENNA.

In CANADA: Fibre-Metal (Canada) Limited, Toronto



Choose high-pressure gas cylinders from the HACKNEY "Family"

Shown here are ten popular Hackney high-pressure gas cylinders for industrial and medical services.

They are popular because they more than pay their way through long, maintenance-free service.

Lightweight, without sacrificing safety, strength or durability, Hackney deep drawn cylinders:

- save money on shipping costs
- reduce handling costs
- cut maintenance costs—smooth surfaces clean easily, paint quickly
- provide full capacity—no need for complaints
- require minimum storage space per cylinder
- earn customer good will—attractive appearance in doctors' offices, clinics, hospitals, etc.
- permit you to serve *all* customers with cylinders of the size they need
- exceed all ICC specifications

1 5-lb. CO_2 5¼" x 13⅞"
2 80 cu. ft. oxygen 6⅛" x 32½"
3 "D" Medical 3¾" x 16¾"
4 250 cu. ft. oxygen 8⅝" x 51"
5 "A" Medical 3⅛" x 7⅞"
6 20-lb. CO_2 7.45" x 23¼"
7 11 cu. ft. oxygen 3⅜" x 18⅞"
8 110 cu. ft. oxygen 6⅝" x 43"
9 "E" Medical 3¹⁵⁄₁₆" x 25¾"
10 10-lb. CO_2 6½" x 18⅝"

SEND FOR NEW BULLETIN. Gives complete facts about Hackney manufacturing features, range of capacities and sizes, ICC specifications, and other helpful information. Write:

Pressed Steel Tank Company

Manufacturer of Hackney Products Since 1902

1456 South 66th Street, Milwaukee 14, Wisconsin

Branch offices in principal cities

Hackney

CONTAINERS AND PRESSURE VESSELS FOR GASES, LIQUIDS AND SOLIDS

Rectifier welder

New d-c arc welder, Aircomatic Fillerarc, is said to combine the tested features of a rising characteristic power source with the advantages of transformer-rectifier design. A primary advantage is stepless adjustment of arc length and rate of rise for various wire diameters. Welder is rated at 450 amp, d-c, 40 volts, 100% of duty cycle. Weight is 665 lb; dimensions are: 28-in. high by 25-in. wide by 46½-in. long. *Air Reduction Sales Co.*

Circle No. 31

Twin-purpose wheel

Raised hub disc-wheel, Bayflex Double-Duty, both grinds and finishes, because of two-layer construction. Coarse-grained layer operates when wheel is held at 30 to 45 deg angle; finishing layer operates at 10 to 20 deg angle. Finishing layer is available in five different grits, while stock-removal layer is same grit in all wheels. *Bay State Abrasives Co.*

Circle No. 32

Rain hood

New vinyl rain hood (R-1) may be installed easily in firm's Fiberglas aluminum hats or caps. Material is flexible at low temperatures. Full 360-deg ventilation under crown, and around hat or cap suspension is provided, manufacturer claims. *Fibre-Metal Products Co.*

Circle No. 33

Plastic welding rod

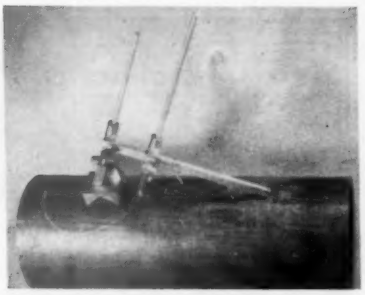
Rods are held to close tolerance and are porous free, come packaged in tubes containing 2½, 5 and 25 lb of material. In 48-in. straight lengths, the diameters are ⅛, 5/32 and 3/16-in. Linear polyethylene rod comes only in ⅛-in. diameter. *Laramy Products Co.*

Circle No. 34

Hydraulic cylinders

A new line of heavy-duty air and hydraulic cylinders, built to JIC standards for use on automated and other high production machinery is available. Valvair heavy-duty cylinders have certain unique design features, such as extra long bronze rod bearing with length-to-rod diameter ratios of up to 2:1. The Hycar rod wiper and metallic-backed rod seal are in an easily-removed cartridge. Removable cylinder port adapters permit replacement of cylinder assembly without disturbing basic piping connections. *Valvair Corp.*

Circle No. 35



Pipe marker

Hours of templet making are said to be eliminated by using this speedy, accurate pipe marker. Tool will mark down to 3-in. diameter pipe. Moderately priced, and instruction card comes with every tool *Sury Engineering & Sales Co.*

Circle No. 36

Volt-amp tester

Amprobe Junior is pocket-sized, snap-around, volt-amp tester in safety yellow. Trigger-operated jaws snapped around conductor give reading without ammeter connections. Voltage is measured by plugging leads into instrument, and clipping to load. Available in 25, 50 or 100-amp full scale in either 125/250 or 150/600 volts. *Amprobe Div. Pyramid Instrument Corp.*

Circle No. 37

Plastic safety hat

Molded high-impact plastic safety hat has an adjustable, all-plastic suspension. The suspension can be adjusted exactly to sizes from 6⅝ to 7¾. Both the detachable sweatband and two-part suspension are replaceable. Hat is available in gray, white and yellow. *Davis Emergency Equipment Co.*

Circle No. 38

Coupling assemblies

Kamlok couplings with Viton-A-Gaskets are for use where hose or pipe connections are disconnected periodically to save time and operating costs. They are suitable for pressures to 200 psi and temperatures to 500 F. Gaskets can be used with hard to handle chemicals. Couplings are available in ½-in. to 6-in. sizes in aluminum, bronze, monel, stainless and semi-steel. *OPW-Jordan.*

Circle No. 39

Sweatbands

Two different sweat absorbers: Coolband, which fits on forehead with an elastic band; and Cool-Ur-Hat, designed for use with safety hats, are said to aid worker efficiency. Both are made from cellulose sponge that can be kept sanitary by squeezing in soapy water and rinsing out excess water. Cool-Ur-Hat features a plastic fastener that folds over head band and snaps in place to keep sponge absorber in fixed position. *Mine Safety Appliances Co.*

Circle No. 40

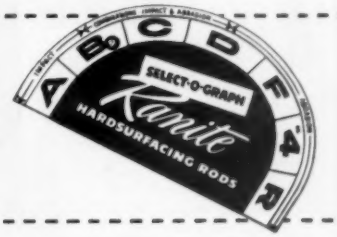
Ranite–The ORIGINAL Metallic-Coated Hardsurfacing Rod

is still easiest to select, easiest to use and offers the most advantages!

NO OTHER HARDSURFACING MATERIAL OFFERS ALL THESE ADVANTAGES:

- Equally good operation with AC and DC machines
- Readily applied in all positions
- Quiet, stable arc
- No Splatter loss
- No slag to remove
- Clear welding vision
- Economical because there is minimum of flux, maximum of material to enter weld
- Arc easily re-struck, if broken for any reason
- Very little tendency for deposit to check because rods alloyed with proper coefficient of expansion
- Firm bonding of deposit to base metal
- Ranite-coated surfaces can be torch-cut when necessary, thus reducing repair costs
- Rapid deposition rate cuts welding time
- High recovery rate assures more *deposited* metal per pound
- Broad latitude of Ranite rods gives weldors ample leeway in selection and use
- Correct rod selection is simple and easy–the big majority of all jobs are handled by just five Ranite rods–A, BX, C, D and No. 4

GET FREE Ranite Select-O-Graph Guide—shirt pocket size—shows best rod to meet any wear condition. Ask your Ranite distributor or write direct.



Originators and pioneers of metallic-coated rods—since 1938

Ranite
WELDORS' NO. 1 CHOICE FOR HARDSURFACING

RANKIN MANUFACTURING CO.
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Alhambra, Calif.

New TUFFALOY MUCH IMPROVED Tip Holders

For long life and ease of maintenance, TUFFALOY Series "E" straight ejector-type holders combine top performance with great simplicity of design.

The entire sturdy brass head, with its attached ejector tube, is forced into the barrel to eject the welding tip. Two rubber water seals prevent leakage. They are placed inside the barrel, hidden from dirt and damage. This design eliminates the small, easily distorted ejector plunger extending through the stationary head of most holders now on the market.

A threaded coupling holds head and barrel together, and permits the head to swivel freely. Loosen the coupling, even without removal from the machine, for inspection and maintenance.

Made in twelve models: barrels are 8" and 12" long, 1", 1¼" and 1½" diameter, and hold No. 1 and No. 2 Morse taper tips in threaded adapters, furnished as part of each holder. Adapters are RWMA class 2 alloy to reduce wear of the tip socket.

TUFFALOY Resistance Welding Alloys are widely available through AIRCO and TUFFALOY representatives. Call on them for Spotwelding Tips (Standard, TUFFCAP, Cold-Bent, and Special), Holders and Adapters, Bar Stock, Forgings, Seam Welding Wheels, and all other welding alloy needs. Ask for Catalog and Price List.

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A Division of Air Reduction Co., Inc.
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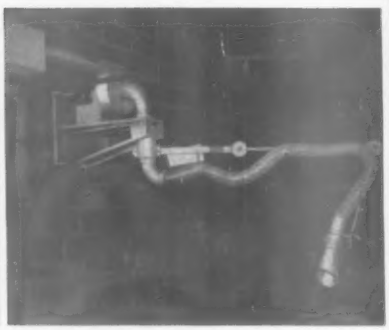

Welding fume exhausters

- Systems have been approved for Government Health Depts. in U. S. & Canada.
- Guaranteed for highest efficiency.
- Portable & Stationary units for all applications.
- Unlimited flexibility; fast, easy positioning over 360°.
- Blowers attachable to units or mounted at remote points.
- Units can be connected in series.
- Available in 9, 12 or 15-ft. reach units.
- Complete installation can be easily done by your own men.
- Engwald Exhausters come complete with mounting brackets.

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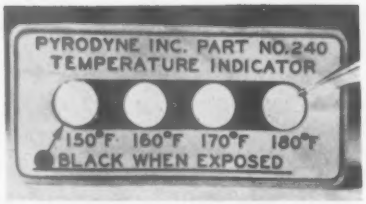


Temperature indicators

Temp-Plate is a small plastic label capable of indicating surface temperatures. Labels are backed with adhesive, and register a permanent change from white to black as stated temperature level is reached. They adhere to surfaces under wide range of exposure conditions. Now available for indication from 100 through 700 F in a choice of 50 increments. *Pyrodyne, Inc.*

Circle No. 41

Clamping system

Hydraulic clamping system enables tool engineers to design fixtures with multiple clamps, actuated from a single self-contained source. System has no external power source connections and is made in sizes suitable for most clamping operations. Self-contained hydraulic supply permits fixture movement. Manufacturer says cost is within range of ordinary screw, cam or mechanically actuated clamps. *Newton Hydraulic Tooling Co.*

Circle No. 42

Current pick-up unit

Called Anchor model A Hi-Amp Pick-up, this trolley device has capacity for handling up to 1,200 amp. Travels on bus bar (rail) and transmits high current electrical power while in motion or at rest. Brush replacement and other maintenance can be done without removing pick-up from the rail. Specially designed for welding and plating systems. *Anchor Steel & Conveyor Co.*

Circle No. 43

Thickness gage

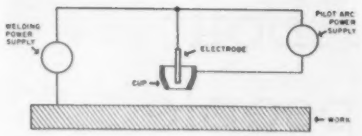
Apparatus will measure wall thickness of hollow containers with narrow necks, such as glass bottles, steel cylinders, oxygen and acetylene tanks, etc. Can take gage measurement to a distance of 325 mm from mouth; will go through openings down to 13 mm. Smaller model is available for measuring containers with smaller necks. *Testing Machines, Inc.*

Circle No. 44

Thyratron tubes

Tubes are designed for general purpose control and welding control service. In addition to xenon filling to minimize tube voltage drop, each tube has rugged button system to assure immunity from mechanical failure. A special carbonized nickel grid is employed. WL-7306 xenon-filled thyratron is direct replacement for 5684, C3JA, 5632 and C3J. Because of its mercury and xenon filling, the WL-7307 has a long life. *Westinghouse Electric Tube Div.*

Circle No. 45



Arc starting

Arc starting with Pilot-Arc now makes it possible to get positive starts for Heliarc (Tig) spot welding or cutting in a split second, whenever required, it is claimed. Pilot-Arc acts much as the pilot light in gas stove. Small quantity of shielding gas flows continuously and protects electrode while pilot is on. Electrode is maintained in an incandescent state so that torch is always hot and ready to fire. *Linde Co.*

Circle No. 46

Soldering machine

Automatic induction soldering and brazing machine is floor-mounted and operates from 115 to 230-volt a-c lines. It consists of a Reevelec L4D 1 kw high frequency induction heating generator, and a variable speed, motor-driven turntable. Turntable diameters of 18 to 36 in. are available with speeds from 1/6 to 10 rpm. Equipment is suited to capacitor lead and bracket soldering, can and crystal soldering, relay and switch contact soldering and brazing. *Reeve Electronics Inc.*

Circle No. 47

Welding screen

Porto-Screen is a portable, self-standing screen that protects against fire and high radiant heat. Cover material is Ray-Foil, a UL approved, aluminized asbestos cloth. Porto-Screens come in 5 and 6-ft heights, and a variety of widths. Slip-on fittings for your own pipe or tubing are included with each kit. *Frommelt Industries*

Circle No. 48

Blasting nozzle

Uniflo nozzle designed for shot, grit and sand blasting is reported to retain orifice size for a long time, thereby keeping the blast concentrated to aid cleaning and save compressed air. Nozzle liner is tungsten carbide. Jacket is kirksite, an alloy of zinc, aluminum, copper and magnesium. Orifice sizes are 3/16, 1/4, 5/16, 3/8, 7/16 and 1/2 in. A 3/4-in. size is also available. *W. W. Sly Manufacturing Co.*

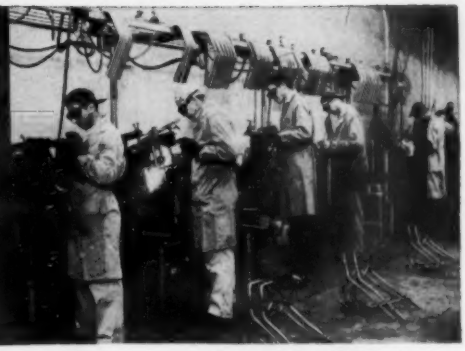
Circle No. 49

Blast-cleaning cabinets

Airless cleaning cabinets are designed to meet needs of users whose production rates outstrip capacity of standard blast equipment, but are not large enough to warrant high production equipment. Each machine features compartmental work areas, spinner devices for rotating, Wheelabrator airless blast units, and work-carrying fixtures. Blasting is continuous in operation with one compartment always exposed to operate for loading and unloading. *Wheelabrator Corp.*

Circle No. 50

TOP QUALITY
FLUXES
made by All-State for
WELDING
BRAZING
SOLDERING



Production line brazing with automatic fluxing system. Information on All-State JET FLUX® on request.

POWDERED flux is micro-ground;
PASTE flux is homogenized

At ALL-STATE each flux is manufactured to rigid specifications, tailored for best results with specific alloys. For example, ALL-STATE's S-200 silver brazing flux affords complete protection to heated base metal to 1800° F., insuring excellent capillary action and easy flowing of silver alloy. Melts at 600° F. Equal care is built into other fluxes made by ALL-STATE to assure oxide-free bonding of all metals at low temperatures.

Ask for free copy of 58-page Instruction Manual. Write for information on fluxes custom coated on your own rods.

All-State
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Call WHite Plains 8-4646 or write for nearest distributor

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MATERIAL HANDLING DEVICES

- Safety Factor—5 to 1
- Factory tested at triple rated capacity.
- Will lift from horizontal or vertical position.
- Cam and Pads of case hardened tool steel.
- All operating parts replaceable when worn.
- Swinging or jerking loads will not affect grip.
- Useful for positioning in welding operations.

The HEAVIER the LOAD • • • the TIGHTER the GRIP! 3-T-17

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HI-AMP®

World Leader in Arc Welding Supplies

Electrode Holders to fit every manual arc welding requirement from the smallest rod to the heavy iron coated electrodes. Bright Yellow Glass Fibre handles, high heat resisting Insulators, Interchangeable parts are but a few of HI-AMPS outstanding qualities. Ground Clamps built for excessive abuse with strong grip to give perfect contact. Cable connectors built for heavy duty and ease of connection. A simple twist of the wrist gives locked cable connection.

You can't go wrong with HI-AMP

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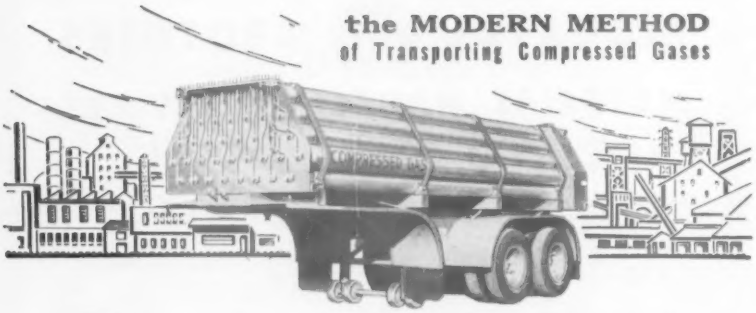
the MODERN METHOD of Transporting Compressed Gases



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About people . . .

William M. Haile has been elected a vice president of Union Carbide Corp., New York City. The former president of Linde Co. will now supervise activities of Linde, National Carbon Co., and Union Carbide Metals Co. *William B. Nicholson* succeeds Haile as Linde president.

Dall

Cassidy

Linde Co., New York City, has appointed *J. J. Dall*, assistant general manager, electric welding. His responsibilities will include all phases of the firm's electric welding processes. In another Linde appointment, *Warren G. Gumm* was named manager of engineering, railroad department. He will be located in Chicago.

John C. Cassidy has been appointed Chicago district sales manager of Page Steel & Wire Div., Monessen, Pa. The Chicago district covers states of Illinois, Missouri, Kansas, Indiana, Wisconsin and Minnesota.

Fred O. Snyder has become manager of district sales office in Cincinnati for Worthington Corp., Harrison, N. J. Mr. Snyder succeeds *Ralph G. Griffin*, who has been transferred to the company's main office.

Four district manager promotions have been made by National Cylinder Gas Div., Chicago. *Lawrence J. Roper* is now manager at Kansas City; *Robert E. Buzard*, at Portsmouth, Va. At North Bergen, N. J., *Oscar F. Boerner* was named assistant district manager, and at Cincinnati, *Lauren W. Sage* was made assistant district manager.

Westerson

Mendenhall

C. G. Westerson has been promoted to southeastern district sales manager for Smith Welding Corp., Minneapolis. He will be headquartered at Ferguson, Mo. *Harold Mendenhall* was appointed technical sales engineer for Smith's sales department.

Metal & Thermit Corp., Rahway, N. J., has appointed *Dr. R. M. Kary* as a member of its research staff. He was previously employed by American Smelting & Refining Co., South Plainfield, N. J.

Howard D. Hartough has been elected president of the Chemical Products Div. of Chemetron Corp., Chicago. For the present he will headquarter in Louisville, supervising operations of the division, which include Crestwood Chemical Co., Dunham Chemical Co., Girdler Catalysts and the Holland Color & Chemical Co. *Lansing M. Hinrichs* has been appointed assistant to the president. Hinrichs will continue as patent counsel in addition to his new duties.

General Electric Co., Schenectady, has made four appointments in a recent change of its Power Tube marketing organization. The new managers are: *Ardell C. Rowe,* beam tubes; *Keith E. Wilson,* ignitrons, thyratrons and special purpose tubes; and *Wilbur F. McKeehan,* magnetrons, space charge and camera tubes. *Albert C. Gabel* has been named manager of market research and product planning practices.

Harold Flynn, formerly with Pandjiris Weldment Co., St. Louis, and J. A. Cunningham Equipment Co., Philadelphia, has joined Unique Equipment Inc., Brooklyn.

Whitehead Metals, Inc., New York City, has made three new appointments. *Carl S. Newmarch* was made manager of the Philadelphia branch. *J. I. Doherty* becomes manager of the Cambridge, Mass., branch. *C. C. McCarthy* is now manager of the Windsor, Conn., branch.

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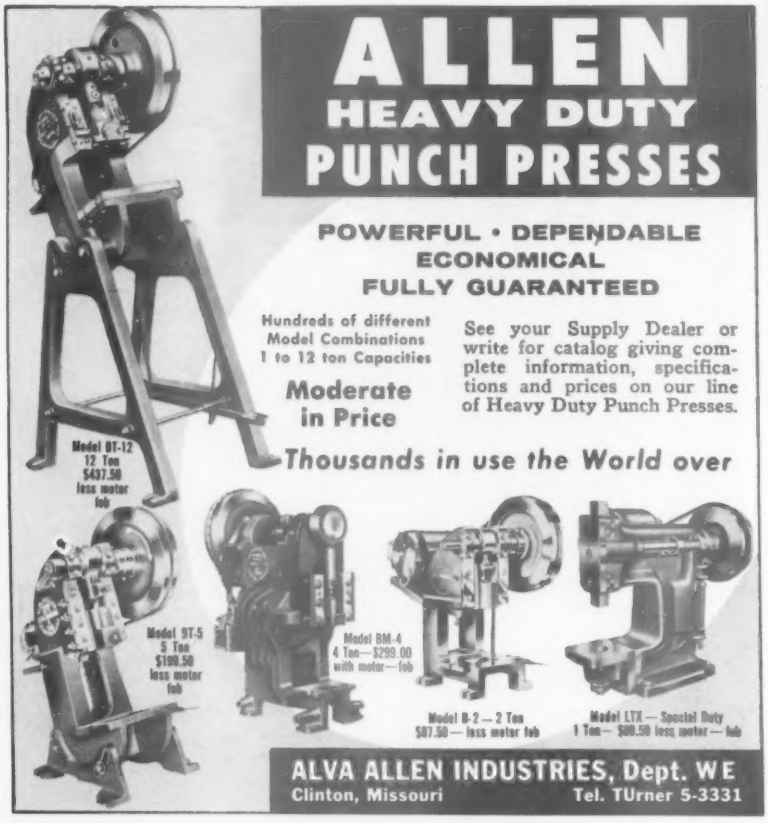
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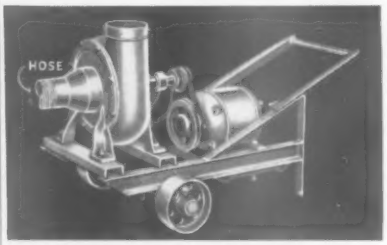

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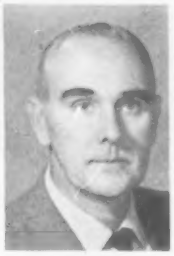

Hilton

Randall

L. S. Hilton has been appointed manager of the Abrasive and Diamond Wheel Depts. of Manhattan Rubber Div. of Raybestos-Manhattan Inc., Passaic, N. J. He succeeds *J. A. Lange*, who will now be concerned with improving methods and quality. *C. Fleming, Jr.*, has been made production and development manager.

Frank Randall, president of Amperex Electronic Corp., is now vice president of North American Philips Co. Inc., Mount Vernon, N. Y. He retains his presidency of Amperex, as well as being a vice president and director of Ferroxcube Corp. of America, Saugerties, N. Y.

Keith D. Millis of The International Nickel Co., Inc., New York City, was recently presented with the Annual Achievement Award in Metallurgy of the New York chapter of the American Society for Metals. He is the assistant to the manager of Inco's development and research division at New York.

Gregory Industries Inc., Lorain, Ohio, has made eight new field engineer assignments, as follows: *Edward Sundberg*, Los Angeles; *Robert G. Pickering*, Philadelphia; *Charles W. Roberts*, Birmingham; *Robert Igoe*, Buffalo-Rochester; *John L. Harmon*, Detroit-Toledo; *Delmar V. Sprowls*, Kansas City; *Murray Gibbs* and *Paul Blake* have been assigned to the firm's Toronto office.

Died . . .

Garry Van Haste, advertising manager of Handy & Harman, New York City, died May 30, at his home in Ramsey, N. J., at the age of 48. Mr. Van Haste began his career with G. M. Basford Co., New York City advertising agency. In 1943 he joined Handy & Harman and in 1957 became advertising manager.

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30 YEARS AGO

(Taken from the WELDING ENGINEER of July, 1929)

—30 YEARS AGO—

J. M. Mathews of Harris Calorific Co., Cleveland, has just returned from a two-weeks trip to the larger North Pacific Coast cities. Arrangements were made for the newly formed Blue Tank Oxygen Co., Seattle, to handle the Harris products in Oregon, Washington and British Columbia.

—30 YEARS AGO—

Thomas Ketchbaw, Chicago consulting engineer, has announced the opening of a new welding engineering service office located at 2030 Broadway, Chicago.

—30 YEARS AGO—

The current issue of the Pure Iron Era carries a feature article, "The wonder world of welding", written by W. W. Petry. The author reflects a thorough understanding of recent progress in welding.

—30 YEARS AGO—

In a recent copyrighted dispatch published in the **New York Times,** Commander Richard Byrd vividly described the hardships of Antarctic flying. In speaking about Ford tri-motored planes, he said, in part, ". . . the strength of modern welded steel construction has been many times demonstrated."

—30 YEARS AGO—

The name of the C. H. Hollup Corp. has been changed to Hollup Corp. The eastern division, now known as Hollup Corp. of New York, was formerly called the Transportation Engineering Corp.

—30 YEARS AGO—

Among the papers to be presented at the fall meeting of the American Welding Society in Cleveland are: "Non-destructive tests of welds", by Elmer Sperry, Sperry Development Co., Danbury, Conn.; "Welding of pipelines", by H. C. Price, Welding Engineering Co., Bartlesville, Okla.; "Cutting and welding steel parts to replace castings", by W. J. Buchanan, Bessemer Gas Engine Co., Grove City, Pa.

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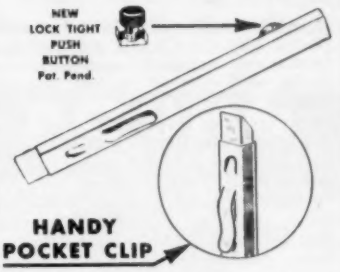

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76. AMPERAGE INDICATOR—Emerson Electric Mfg. Co. Circular slide rule shows correct amp settings for specific electrodes to be used with 90 to 200 amp, d-c, company gas-driven units.

77. STAINLESS FITTINGS—Tube Turns, Div. of Chemetron Corp. Bulletin illustrates how Pipe-Mate light-wall fittings and non-critical process pipe are joined.

78. NICKEL-BASE ALLOY—Haynes Stellite Co. Brochure gives developmental-stage data on Hastelloy alloy N, intended as container material for molten fluoride salts.

79. ALUMINUM-BRONZE ALLOY—Ampco Metal Inc. Ampco Technical Review bulletin gives welding characteristics, forming and machining properties of new alloy. Various corrosion applications in industry are given.

80. WELDING GUIDES—The Guide Weld Co. Set of catalog pages describes rotating and gun-type guides and required components for Nos. A-1006 and A-1025.

81. HARD ALLOY STEEL—Jones & Laughlin Steel Corp. Four new hardness ranges of Jalloy, a heat-treated and abrasion-resistant alloy steel are described in pamphlet. Weldability and other factors are covered.

82. GAS FLOW CONTROLS—Air Reduction Sales Co. Catalog describes line of gas flow control equipment for argon, helium and CO_2. Includes new series of fixed-pressure regulators.

83. SEMIAUTOMATIC WELDING—Reid-Avery Co., Inc. Bulletin RD-400 describes Dynaweld semiautomatic welding system, independent of water cooling and gas shielding. Unit is portable and operates from a-c or d-c.

84. RECLAIMING—Wall Colmonoy Corp. Issue of Alloy News, vol 4, no 2, features how U.S. Navy uses Sprayweld process and Colmonoy No. 6 alloy to reclaim worn engine exhaust valves.

85. CUTTING ATTACHMENT—Or-O-Co Tool Co. Flyer illustrates precision circle cutting with special acetylene torch-cutting attachment.

86. BRAZING ALLOY—American Brazing Alloys Co. Data sheet 170 gives facts on Phos-Sil 15, copper, brass and bronze purpose alloy for brazing non-ferrous metals only.

87. BRASS FITTINGS — Western Enterprises Inc. Catalog 59-1W lists line of brass fittings for all types of welding equipment.

88. GRINDER—L & B Welding Equipment Inc. Specifications bulletin describes Model RG-2 grinder for finishing rebuilt roller and idler surfaces.

89. SWEAT ABSORBERS—Mine Safety Appliances Co. Bulletin 0408-16 describes both a forehead sweat absorber with an elastic band and Cool-Ur-Hat, which fits inside safety hats, helmets, and for use with face shields.

90. HIGH-STRENGTH STEEL—International Nickel Co., Inc. Booklet: "300-M Ultra Hight Strength Steel," gives propert es with charts and tables on new upper tensile strength steel with a moderate carbon content, and deep hardening qualities.

91. GRINDING WHEELS—Simonds Abrasive Co. Bulletin ESA-299 pictures popular sizes and shapes of resinoid depressed center wheels and bonded straight wheels, flaring cup and mounted wheels.

92. RUST PREVENTIVE—American Solder & Flux Co. A 95% metallic zinc coating is described in Bulletin 5650. Liquid Drygalv is brushed on and will stop corrosion at welded joints.

93. LIQUID-OXYGEN CYLINDER—Linde Co. Brochure specifies applications for the LC-3 cylinder with its 3,000-cu-ft capacity in a single, compact container weighing only 510 lb when full.

95. WELDING SCALE REMOVER—Chemclean Products Corp. Flyer gives features of Ox-Off 536, a colorless, acid-type liquid for removing most types of welding scale and oxidation from stainless steel. A portable electric applicator unit is also described.

96. HAND BRAZING—Handy & Harman. Brazing News, No. 81 Hand Torch edition, illustrates specific applications for Handy B-1 Flux, Braze 541, and Easy-Flo 45 in various silver alloy brazing operations.

97. WELD HOSE—Hewitt-Robbins Inc. Bulletin H-4A pictures applications for Twin-Weld hose, and single-line Servall hose, both using red and green for safe gas identification.

98. HOSE ACCESSORIES—Le-Hi Div. of Hose Accessories Co. Hose couplings, clamps, valves and manifolds, nipples and hydraulic assemblies are covered in pamphlet.

99. ELECTRICAL CONNECTIONS—Erico Products Inc. Price list includes sizes, catalog numbers and quantities for Cadweld cartridges, crucibles, lugs, sleeves, etc.

100. MAINTENANCE EQUIPMENT—National Cylinder Gas. Bulletin N-112 features an all-purpose welding and cutting outfit, Combo Kit. Shop Welder S-30C, for a-c operation and a portable welder Model SGW are also fully described.

102. CABLE MAINTENANCE—F. M. Anthony Co. Booklet answers questions on welding cable maintenance and repair through use of Insul-Lock lugs, tips and insulators.

103. COPPER ELECTRODES—Krembs & Co. Folder explains technique of metallic arc welding process using copper and all copper alloys. Kop-R-Arc electrodes and Fluxine coating are described.

104. CHISELS—Bedford Tool & Forge Co. Bulletin C-59 specifies chisels for pneumatic chipping hammer, scaling hammer and hand use. Safety-Head hand tools are made with high alloy steel.

105. GAS-AIR MIXER—Waukee Engineering Co. Bulletin 401 illustrates and specifies for Panel Mixor, that has a compressor-carburetor device to accurately mix gas and air in any selected ratio, and compresses it for use in torch brazing, flame heat-treating, etc.

106. GAS CONTAINER—Ronan & Kunzl, Inc. Data sheet concerns Model 50-6, a 50-gal liquified gas Cryotainer. It is castermounted, equipped with handles and bumper guards.

107. BRAZE TESTER—Pioneer Industries. Brochure gives all data on Hot Shot Tester, a unit designed to detect poor quality braze in any finished assembly. Units are equipped with two flash heaters.

108. STUD WELDING—Nelson Stud Welding. Illustrated brochure explains endwelding of fastener studs to storage tanks. Nelweld Method No. 2 involves the tack welding of light steel strips to the tank; both methods utilize Setlock fasteners.

109. MANIFOLDS FOR GASES—Air Reduction Sales Co. Catalog 829 describes complete line of Airco manifolds. Includes capacities, dimensions and arrangement.

110. WELD FASTENING—McLaughlin Co. General catalog lists clinch, pilot and weld nuts. Includes specifications and applications.

111. HEAD & TAIL STOCKS—Cayuga Machine & Fabricating Co., Inc. Bulletin 5703 shows how Cayuga-Matic head and tail stocks are suitable where a positioner would not be applicable.

112. GRINDING SAFETY—Carborundum Co. Convenient size wall chart contains ten "Do's" and ten "Don'ts" on subject of grinding wheel safety .

113. ABRASIVE DISCS—Abrasive Co. of America. Illustrated price list gives complete data on company's Magnecoated abrasive discs.

114. TORCH CONVEYOR—Indiana Oxygen Co. Brochure explains applications of Cut-A-Line, portable, electrical operated carriage, designed to convey one or more torches used in cutting, welding, flame hardening, etc.

115. MACHINABLE CERAMIC—Duramic Products Inc. Technical Bulletin 118 describes heat shock-resistant ceramic, HT-2-M; includes machining information.

116. ELECTRONIC WELDERS—Vacuum Tube Products Co., Inc. Short Form Catalog describes complete line of cabinet welders, bench welders and fractional cycle timers.

117. RESISTANCE WELDING — Sciaky Brothers Inc. Publication, Resistance Welding at Work, vol. 5, no. 4, fully describes six commercial and aviation case histories where resistance welding was employed.

118. ELECTRODE HOLDER — Weldma Co. Flyer gives decription of RWT-1002 lower electrode wheel holder, for resistance welding, which can be used for flat as well as circular workpieces.

119. SILVER BRAZING—Fusion Engineering. Technical bulletin 88-1 describes three types of silver brazing pastes (S-4, St, and S-5), covering virtually all applications of silver brazing.

126. CONVEYOR BELT—Raybestos-Manhattan Inc. Brochure M302 graphically describes features of Ray-Man conveyor belt. It is claimed no breaker fabric is needed with this belt.

127. BRAZING ALLOYS—Western Gold & Platinum Co. Catalog V-124 gives characteristics of complete line of low vapor pressure, precious metal brazing alloys for vacuum systems.

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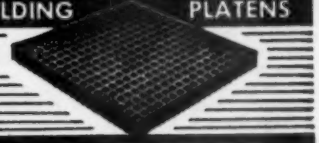

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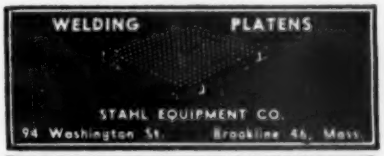

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150. Air Reduction Sales Co.—Catalog 1318 on the new stainless electrode, "Easyarc 308".

151. Alloy Rods Co.—A report to piping contractors on "Atom-Arc" iron powder low hydrogen electrodes is availlable.

152. All-State Welding Alloys Co., Inc.—Write for information on fluxes custom coated on your own rods, and a 58 page instruction manual.

153. Aluminum Co. of America—Further information available on aluminum welding and brazing processes and a loan of films on joining aluminum.

154. Alva Allen Industries—Write for catalog giving complete information, specifications, and prices on Allen's heavy duty punch presses.

155. American Brass Co.—Publication B-13 with comprehensive information on "Anaconda" welding rods and procedures is available.

156. American Platinum & Silver Div.—"A Complete Guide To Selective Fluxing For Low Temperature Silver Brazing" is available.

157. American Platinum & Silver Div.—Also available is "A Complete Guide to Successful Silver Brazing."

158. Ansco Div. of General Aniline & Film Corp.—Write for further information on Ansco's x-ray films.

159. Atlas Welding Accessories, Inc.—Information available on the new Atlas "Easy-Grip" with wide blades.

160. Bernard Welding Equipment Co.—Write for further information on the "Short-stub" electrode holder.

162. Contour Marker Corp.—Further information available on the "Curv-O-Mark" pipe-layout tools, for marking pipes and structural angle cuts of any type.

163. Drawalloy Corp.—For complete information on every grade of Drawalloy wire write for Bulletin 355DC.

164. Electric Arc Inc.—Brochure available, "Smith-Dolan System of Low-Frequency Induction Heating."

165. Engwald Corp.—Catalog WE-7 on welding fume exhausters available.

166. Eutectic Welding Alloys Corp.—Data book on "Low Temperature Welding Alloys" available.

167. Fibre-Metal Products Co.—Catalog No. 26 available on "Fibreglas" welding helmets.

168. Flood Safety Products Co.—Information available on fiber glass helmets and other welding and safety equipment.

169. Goldsmith Brothers Smelting & Refining Co.—Data book on silver brazing available.

170. Handy & Harman—Bulletin 20 explains silver brazing and its benefits.

171. Harnischfeger Corp.—Additional information available on P & H equipment for programmed welding.

172. Harrisburg Steel Co.—Write for information on gas cylinders manufactured by Harrisburg.

173. Haynes Stellite Co.—"Mechanized Hard-Facing" explains which of your hard-facing jobs are suitable for mechanization.

174. Hobart Brothers Co.—Further information on the Hobart line of welders and a sample of the "Rocket 24" iron powder electrode.

175. Hobart Brothers Co.—Samples of the new "335" electrode for structural steel welding available and information on Hobart's non-profit welding school.

176. Independent Engineering Co.—Information available on transporting gases by gas supply trailers.

177. International Nickel Co.—Booklet available, "Repair Cast Iron Parts Quickly and Easily."

178. Jackson Products—Further information available on insulated copper alloy holders, ground clamps, cable connectors and the Jackson "Cablehitch."

179. Lenco, Inc.—Write for further information on the "Hi-Amp" electrode holder.

180. Lincoln Electric Co.—Further information on the "Jetweld 1" iron-powder electrodes.

181. Linde Co.—Write for further information on the new "Sigma ST-2" hand welding torch.

182. Linde Co.—Further information available on "Oxweld" goggles and gloves, and name and address of your nearest supplier.

183. Maitlen And Benson, Inc.—Information on "Wypo" cutting and welding tip cleaners.

184. P. R. Mallory & Co.—Catalog available, "Standard Resistance Welding Electrodes."

185. Merrill Brothers—Information on material handling devices.

186. — Messer Cutting Machines, Inc—Write for further information on Messer's line of precision cutting machines.

187. Miller Electric Mfg. Co. Inc.—Further information on the Miller "Fireball" welder sent on request.

188. National Carbide Co.—Write for further information on calcium carbide and name and address of your nearest distributor.

189. National Welding Equipment Co.—Further information available on cutting tips with 3 internal cone seating surfaces.

190. Page Steel & Wire Div.—Folders available on submerged arc and inert gas automatic welding wire.

WELDING INFO-AIDS

USE THIS CARD for Literature, Catalogs, and Bulletins shown on preceding pages and for those featured in this month's ads as listed opposite and on following page

Also information about

NEW PRODUCTS described on pages 54 to 65

Every month WELDING ENGINEER lists many new catalogs and bulletins available from manufacturers. All are yours for the asking. However, this service is valuable to you only if you use it.

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★ For copies of any manufacturers bulletins described on these pages circle the number of the items on card at right. Fill in your name, title, company and address. This has to be done only once on either post card. You need no postage.

★ For additional information on New Products described in this issue, circle the numbers of the items that interest you. The New Products section begins on page 54.

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Illegible or incomplete addresses may keep you from receiving the information you desire. And remember, cards postmarked after the deadline date cannot be processed.

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Literature offered in ads

(Continued from page 72)

191. Phoenix Products Co.—"Dry-Rod as Standard Welding Equipment" gives latest rod drying methods.

192. Picker X-Ray Corp.—Write for further information on radiography.

193. Pressed Steel Tank Co.—Bulletin available on "Hackney" gas cylinders.

194. J. M. Ragle Industries, Inc.—Write for further information on the "Commando" drill kit and other "Commando" products.

195. Randall Mfg. Co.—Further information available on Randall Soapstone holders and other Randall products.

196. Rankin Mfg. Co.—Ranite Select-O-Graph Guide, for easy rod selection available.

197. Ronan & Kunzl, Inc—Write for further information on storage and transport containers.

198. Ruemelin Mfg. Co.—Detailed information on the Ruemelin portable fume collector.

199. Square D Co.—Further information on Magnetic or Electronic welders made by Square D.

200. Stulz-Sickles Co.—Details on ways to solve your severe abrasion problems.

201. Sylvania Electric Products Inc.—Information on Sylvania tungsten electrodes available.

202. Tempil Corp.—Write for sample Tempil pellets and information on Tempilstiks.

203. Tennessee Fabricating Co.—New catalog on castings, tubing, stampings, primers and finishes, garden furniture and machine tools and supplies.

204. Thermacote Co.—Write for complete descriptions of "Thermo" filter plates and cover lens.

205. John Tillman & Co.—Write for catalog on weldor's gloves and garments.

206. Tuffaloy Dept., Air Reduction Sales Co.—Catalog and prices on Tuffaloy spot welding tips, tip holders and adapters.

207. Vickers, Inc.—Electric Products Div. —Descriptive bulletins 7136-1 and 7146-1 available on the "Controlarc" for standard arc welding, constant potential welding and tungsten inert gas welding.

208. Victor Equipment Co.—For precise control and measurement of gases write for additional information on Victor regulators and Victrometers.

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TIG welding is "right" for so many jobs...

Stainless steel coffee jugs for the Air Force have smooth, high-strength welds produced by TIG welding

All-aluminum water towers feature rugged TIG welding of vertical tank sections

...and Sylvania Tungsten Electrodes do the job right...everytime!

From coffee jugs to aluminum water towers—Tungsten Inert Gas welding is adaptable to almost any job. But the quality of the weld is only as good as the tools you use . . .

That's why TIG welders prefer Sylvania Tungsten Electrodes. You can take your pick of all 4 electrode types: Puretung®, Zirtung®, 2% Thoriated, 1% Thoriated. They're available with cleaned or ground finish. And they're color-coded to prevent waste and costly errors.

Sylvania Tungsten Electrodes—the only complete line—are available through all leading distributors. Call yours today.

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WELDING CLINIC

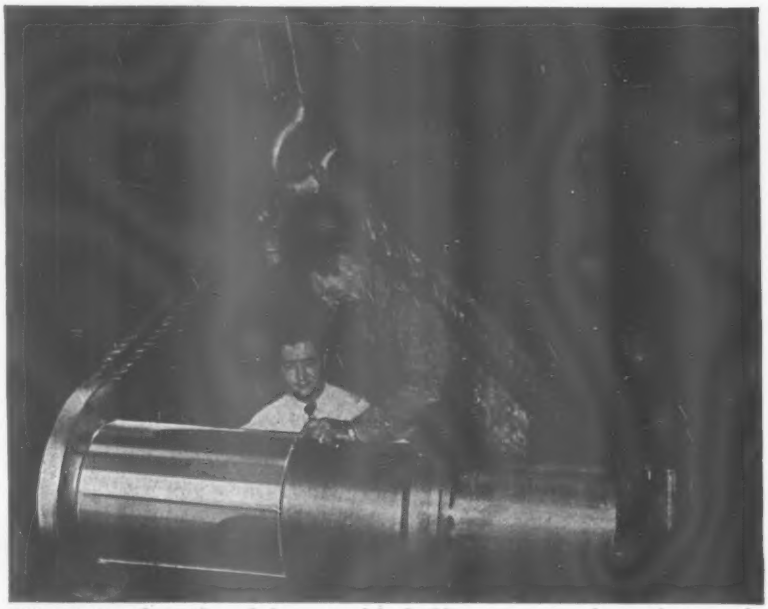
J. Imperati and R. F. Pulver, Welding Engineers
The American Brass Company, Waterbury, Conn.

Give worn equipment a new lease on life by surfacing with Anaconda Welding Rod

Anaconda Welding Rods are widely used in production and maintenance operations in the manufacture of all types of mechanical equipment and consumer goods. Familiar uses are the joining of iron and steel parts by oxyacetylene braze welding and the oxyacetylene braze-welding repair of broken machine parts. Of equal importance is their value in overlaying iron and steel to reduce the friction of sliding surfaces, and in rebuilding worn surfaces to get continued usage from parts that would otherwise be scrapped. Anaconda-997 (Low Fuming) Bronze, Tobin-Bronze 481, and Nickel Silver-828 Welding Rods are useful for many such applications.

Oxyacetylene braze welding is employed for these surfacing and rebuilding operations because of its speed, efficiency, and the convenience of using the equipment and skills available in most job shops. The many advantages, which result from the low temperatures of application, include:

1. ***Procedures which are virtually foolproof.*** The molten bronze automatically tins out and fuses to the base metal when the latter reaches the proper temperature. The rate of heat input is low enough to permit excellent control of the weld metal, and deposits are easily built up even in the vertical position.
2. ***Low residual stresses.*** The overall heating that accompanies the process reduces temperature gradients and minimizes distortion.
3. ***Economy in time*** . . . frequently repair welds are made without dismantling equipment.
4. There is ***no embrittlement of*** cast iron due to high temperatures. Machinability is retained and cracking tendencies are eliminated.
5. ***Absence of iron pick-up*** in deposits made on iron and steel, thereby avoiding hard spots and cracks.



WORN SPINDLE for a 60-ton lathe repaired by building up worn surface with Anaconda Nickel Silver-828 Welding rod by oxyacetylene braze welding. The estimated saving over the cost of a new spindle was nearly $2500.

Surfacing operations which are regularly done with Anaconda Welding Rods include the overlaying of bearing surfaces on iron and steel, and the rebuilding of worn items such as pistons, shafts, valve mechanisms, gear teeth, bearing surfaces, propeller and impeller blades.

Details concerning the type of rod and procedures recommended for surfacing various metals are available in Publication B-13, "Anaconda Welding Rods."

Free technical assistance. In most cases, Anaconda distributors can help you select the exact rod you need for your job. But if you have special problems, Anaconda welding engineers are at your service. For a copy of Publication B-13 with comprehensive information on Anaconda Welding Rods and procedures — or for technical assistance — write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. 8977

ANACONDA®
WELDING RODS
Made by
The American Brass Company